ENCYCLOPÆDIA BRITANNICA

SEVENTH EDITION.

THE

ENCYCLOPÆDIA BRITANNICA

OR

DICTIONARY

OF

ARTS, SCIENCES, AND GENERAL LITERATURE.

SEVENTH EDITION,

WITH PRELIMINARY DISSERTATIONS ON THE HISTORY OF THE SCIENCES,

AND

OTHER EXTENSIVE IMPROVEMENTS AND ADDITIONS;

INCLUDING THE LATE SUPPLEMENT.

A GENERAL INDEX,

AND NUMEROUS ENGRAVINGS.

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ENCYCLOPÆDIA BRITANNICA.

HYDRODYNAMICS.

History.
Definition.

1. HYDRODYNAMICS, from ὑδωρ, "water," and δυναμις, "power," is properly that science which treats of the power of water, whether it acts by pressure or by impulse. In its more enlarged acceptation, however, it treats of the pressure, equilibrium, cohesion, and motion of fluids, and of the machines by which water is raised, or in which that fluid is employed as the first mover. Hydrodynamics is divided into two branches, *Hydrostatics* and *Hydraulics*. Hydrostatics comprehends the pressure, equilibrium, and cohesion of fluids, and Hydraulics their motion, together with the machines in which they are chiefly concerned.

HISTORY.

Hydrodynamics in some respects a modern science.

2. The science of hydrodynamics was cultivated with less success among the ancients than any other branch of mechanical philosophy. When the human mind had made considerable progress in the other departments of physical science, the doctrine of fluids had not begun to occupy the attention of philosophers; and, if we except a few propositions on the pressure and equilibrium of water, hydrodynamics must be regarded as a modern science, which owes its existence and improvement to those great men who adorned the seventeenth and eighteenth centuries.

Discoveries of Archimedes. A. C. 250.

3. Those general principles of hydrostatics which are to this day employed as the foundation of that part of the science, were first given by Archimedes in his work Περι ὀχουμενων, or *De Insidentibus Humido*, about 250 years before the birth of Christ, and were afterwards applied to experiments by Marinus Ghetaldus in his *Archimedes Promotus*. Archimedes maintained that each particle of a fluid mass, when in equilibrio, is equally pressed in every direction; and he inquired into the conditions, according to which a solid body floating in a fluid should assume and preserve a position of equilibrium. We are also indebted to the philosopher of Syracuse for that ingenious hydrostatic process by which the purity of the precious metals can be ascertained, and for the screw engine which goes by his name, the theory of which has lately exercised the ingenuity of some of our greatest mathematicians.

History.

Inventions of Ctesibius and Hero. A. D. 120.

4. In the Greek school at Alexandria which flourished under the auspices of the Ptolemies, the first attempts were made at the construction of hydraulic machinery. About 120 years after the birth of Christ, the fountain of compression, the syphon, and the forcing pump, were invented by Ctesibius and Hero; and though these machines operated by the elasticity and weight of the air, yet their inventors had no distinct notions of these preliminary branches of pneumatical science. The syphon is a simple instrument which is employed to empty vessels full of water or spirituous liquors, and is of great utility in the arts. The forcing pump, on the contrary, is a complicated and abstruse invention, which could scarcely have been expected in the infancy of hydraulics. It was probably suggested to Ctesibius by the *Egyptian wheel* or *Noria*, which was common at that time, and which was a kind of chain pump, consisting of a number of earthern pots carried round by a wheel. In some of these machines the pots have a valve in their bottom which enables them to descend without much resistance, and diminishes greatly the load upon the wheel; and if we suppose that this valve was introduced so early as the time of Ctesibius, it is not difficult to perceive how such a machine might have led this philosopher to the invention of the forcing pump.

Forcing Pump.

Egyptian wheel.

Labours of Sextus Julius Frontinus in hydraulics. A. D. 110.

5. Notwithstanding these inventions of the Alexandrian school, its attention does not seem to have been directed to the motion of fluids. The first attempt to investigate this subject was made by Sextus Julius Frontinus, inspector of the public fountains at Rome in the reigns of Nerva and Trajan; and we may justly suppose that his work entitled *De Aquæductibus urbis Romæ Commentarius* contains all the hydraulic knowledge of the ancients. After

History. describing the *nine*[1] great Roman aqueducts, to which he himself added *five* more, and mentioning the dates of their erection, he considers the methods which were at that time employed for ascertaining the quantity of water discharged from adjutages, and the mode of distributing the waters of an aqueduct or a fountain. He justly remarks that the expense of water from an orifice, depended not only on the magnitude of the orifice itself, but also on the height of the water in the reservoir; and that a pipe employed to carry off a portion of water from an aqueduct, should, as circumstances required, have a position more or less inclined to the original direction of the current. But as he was unacquainted with the true law of the velocities of running water as depending upon the depth of the orifice, we can scarcely be surprised at the want of precision which appears in his results.

The Romans acquainted with the art of conducting water in pipes.

It has generally been supposed that the Romans were ignorant of the art of conducting and raising water by means of pipes; but it can scarcely be doubted, from the statement of Pliny and other authors, that they not only were acquainted with the hydrostatical principle, but that they actually used leaden pipes for the purpose. Pliny asserts that water will always rise to the height of its source, and he also adds that, in order to raise water up to an eminence, leaden pipes must be employed.[2]

6. The labours of the ancients in the science of hydrodynamics terminated with the life of Frontinus. The sciences had already begun to decline, and that night of ignorance and barbarism was advancing apace, which for more than a thousand years brooded over the nations of Europe. During this lengthened period of mental degeneracy, when less abstruse studies ceased to attract the notice, and rouse the energies of men, the human mind could not be supposed capable of that vigorous exertion, and patient industry, which are so indispensable in physical researches. Poetry and the fine arts, accordingly, had made considerable progress under the patronage of the family of Medici, before Galileo began to extend the boundaries of science. This great man, who deserves to be called the father and restorer of physics, does not appear to have directed his attention to the doctrine of fluids: but his discovery of the uniform acceleration of gravity, laid the foundation of its future progress, and contributed in no small degree to aid the exertions of genius in several branches of science.

Labours of Galileo. Born 1564, died 1641.

Of Castelli. Born 1577, died 1644.

7. Castelli and Torricelli, two of the disciples of Galileo, applied the discoveries of their master to the science of hydrodynamics. In 1628 Castelli published a small work, *Della Misura dell 'acque correnti*, in which he gave a very satisfactory explanation of several phenomena in the motion of fluids, in rivers and canals. But he committed a great paralogism in supposing the velocity of the water proportional to the depth of the orifice below the surface of the vessel. Torricelli observing that in a *jet d'eau* where the water rushed through a small adjutage, it rose to nearly the same height with the reservoir from which it was supplied, imagined that it ought to move with the same velocity as if it had fallen through that height by the force of gravity. And hence he deduced this beautiful and important proposition, that the velocities of fluids are as the square roots of the pressures, abstracting from the resistance of the air and the friction of the orifice. This theorem was published in 1643, at the end of his treatise *De Motu Gravium naturaliter accelerato*. It was afterwards confirmed by the experiments of Raphael Magiotti, on the quantities of water discharged from different adjutages under different pressures; and though it is true only in small orifices, it gave a new turn to the science of hydraulics.

Of Torricelli. Born 1608, died 1647.

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Of Pascal. Born 1623, died 1662.

8. After the death of the celebrated Pascal, who discovered the pressure of the atmosphere, a treatise on the equilibrium of fluids (*Sur l'Equilibre des Liqueurs*), was found among his manuscripts, and was given to the public in 1663. In the hands of Pascal, hydrostatics assumed the dignity of a science. The laws of the equilibrium of fluids were demonstrated in the most perspicuous and simple manner, and amply confirmed by experiments. The discovery of Torricelli, it may be supposed, would have incited Pascal to the study of hydraulics. But as he has not treated this subject in the work which has been mentioned, it was probably composed before that discovery had been made public.

Of Mariotte. Died 1684.

9. The theorem of Torricelli was employed by many succeeding writers, but particularly by the celebrated Mariotte, whose labours in this department of physics deserve to be recorded. His *Traité du Mouvement des Eaux*, which was published after his death in the year 1686, is founded on a great variety of well-conducted experiments on the motion of fluids, performed at Versailles and Chantilly. In the discussion of some points he has committed considerable mistakes. Others he has treated very superficially, and in none of his experiments does he seem to have attended to the diminution of efflux arising from the contraction of the fluid vein, when the orifice is merely a perforation in a thin plate; but he appears to have been the first who attempted to ascribe the discrepancy between theory and experiment to the retardation of the water's velocity arising from friction. His cotemporary Guglielmini, who was inspector of the rivers and canals in the Milanese, had ascribed this diminution of velocity in rivers, to transverse motions arising from inequalities in their bottom. But as Mariotte observed similar obstructions even in glass pipes, where no transverse currents could exist, the cause assigned by Guglielmini seemed destitute of foundation. The French philosopher, therefore, regarded these obstructions as the effects of friction. He supposes that the filaments of water which graze along the sides of the pipe lose a portion of their velocity; that the contiguous filaments having on this account a greater velocity, rub upon the former, and suffer a diminution of their celerity; and that the other filaments are affected with similar retardations proportional to their distance from the axis of the pipe. In this way the medium velocity of the current may be diminished, and consequently the quantity of water discharged in a given time, must, from the effects of friction, be considerably less than that which is computed from theory.

The motion of rivers first attended to in Italy.

10. That part of the science of hydrodynamics which relates to the motion of rivers seems to have originated in Italy. This fertile country receives from the Apennines a great number of torrents, which traverse several principalities before they mingle their waters with those of the Po, into which the greater part of them fall. To defend themselves from the inundations with which they were threatened, it became necessary for the inhabitants to change the course of their rivers; and while they thus drove them from their own territories, they let them loose on those of their neighbours. Hence arose the continual quarrels which once raged between the Bolognese and the inhabitants of Modena and Ferrara. The attention of the Italian engineers was necessarily directed to this branch of science; and from this cause a greater number of works

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[1] These nine aqueducts delivered every day 14,000 quinaria, or about 50,000,000 cubic feet of water, or about 50 cubic feet for the daily consumption of each inhabitant, supposing the population of Rome to have been a million. According to Professor Leslie, the supply in modern Rome is forty cubic feet per person, in London three cubic feet, and in Paris one-half a cubic foot.—See *Elements of Nat. Phil.* p. 419.

[2] Plin. xxxvi. 7. See also Palladius *De Re Rustica* ix. 11, &c., and Horace Epist. I. x. 20, Ovid Met. iv. 120.

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were written on the subject in Italy than in all the rest of Europe.

Theory of Guglielmini.

11. Guglielmini was the first who attended to the motion of water in rivers and open canals.[1] Embracing the theorem of Torricelli, which had been confirmed by repeated experiments, Guglielmini concluded that each particle in the perpendicular section of a current has a tendency to move with the same velocity as if it issued from an orifice at the same depth from the surface. The consequences deducible from this theory of running waters are in every respect repugnant to experience, and it is really surprising that it should have been so hastily adopted by succeeding writers. Guglielmini himself was sufficiently sensible that his parabolic theory was contrary to fact, and endeavoured to reconcile them by supposing the motion of rivers to be obstructed by transverse currents arising from irregularities in their bed. The solution of this difficulty, as given by Mariotte, was more satisfactory, and was afterwards adopted by Guglielmini, who maintained also that the viscidity of water had a considerable share in retarding its motion.

Discoveries of Sir Isaac Newton. Born 1652, died 1727

12. The effects of friction and viscidity in diminishing the velocity of running water were noticed in the *Principia* of Sir Isaac Newton, who has thrown much light upon several branches of hydrodynamics. At a time when the Cartesian system of vortices universally prevailed, this great man found it necessary to investigate that absurd hypothesis, and in the course of his investigations he has shewn that the velocity of any stratum of the vortex is an arithmetical mean between the velocities of the strata which enclosed it; and from this it evidently follows, that the velocity of a filament of water moving in a pipe is an arithmetical mean between the velocities of the filaments which surround it. Taking advantage of these results, it was afterwards shewn by M. Pitot, that the retardations arising from friction are inversely as the diameters of the pipes in which the fluid moves. The attention of Newton was also directed to the discharge of water from orifices in the bottom of vessels. He supposed a cylindrical vessel full of water to be perforated in its bottom with a small hole by which the water escaped, and the vessel to be supplied with water in such a manner that it always remained full at the same height. He then supposed this cylindrical column of water to be divided into two parts; the first, which he calls the *cataract*, being a hyperboloid generated by the revolution of a hyperbola of the fifth degree around the axis of the cylinder which should pass through the orifice; and the second the remainder of the water in the cylindrical vessel. He considered the horizontal strata of this hyperboloid as always in motion, while the remainder of the water was in a state of rest; and imagined that there was a kind of cataract in the middle of the fluid. When the results of this theory were compared with the quantity of water actually discharged, Newton concluded that the velocity with which the water issued from the orifice was equal to that which a falling body would receive by descending through half the height of water in the reservoir. This conclusion, however, is absolutely irreconcilable with the known fact, that jets of water rise nearly to the same height as their reservoirs, and Newton seems to have been aware of this objection. In the second edition of his *Principia*, accordingly, which appeared in 1714, Sir Isaac has reconsidered his theory. He had discovered a contraction in the vein of fluid (*vena contracta*), which issued from the orifice, and found that, at the distance of about a diameter of the aperture, the section of the vein was contracted in the subduplicate ratio of two to one. He regarded, therefore, the section of the contracted vein as the true orifice from which the discharge of water ought to be deduced, and the velocity of the effluent water as due to the whole height of water in the reservoir; and by this means his theory became more conformable to the results of experience. This theory, however, is still liable to serious objections. The formation of a *cataract* is by no means agreeable to the laws of hydrostatics; for when a vessel is emptied by the efflux of water through an orifice in its bottom, all the particles of the fluid direct themselves toward this orifice, and therefore no part of it can be considered as in a state of repose.

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The oscillation of waves first considered by Newton.

13. The subject of the oscillation of waves, one of the most difficult in the science of hydrodynamics, was first investigated by Sir Isaac Newton. In the forty-fourth proposition of the second book of his *Principia*, he has furnished us with a method of ascertaining the velocity of the waves of the sea, by observing the time in which they rise and fall. If the two vertical branches of a syphon, which communicate by means of a horizontal branch, be filled with a fluid of known density, the two fluid columns, when in a state of rest, will be in equilibrio and their surfaces horizontal. But if the one column is raised above the level of the other, and left to itself, it will descend below that level, and raise the other column above it, and, after a few oscillations, they will return to a state of repose. Newton occupied himself in determining the duration of these oscillations, or the length of a pendulum isochronous to their duration; and he found, by a simple process of reasoning, that, abstracting from the effects of friction, the length of a synchronous pendulum is equal to one-half of the length of the syphon, that is, of the two vertical branches and the horizontal one, and hence he deduced the isochronism of these oscillations. From this Newton concluded, that the velocity of waves formed on the surface of water, either by the wind or by means of a stone, was in the subduplicate ratio of their size. When their velocity, therefore, is measured, which can be easily done, the size of the waves will be determined by taking a pendulum which oscillates in the time that a wave takes to rise and fall.

Labours of the Marquis Poleni. Born 1683, died 1761.

14. In the year 1718, the Marquis Poleni published, at Padua, his work *De Castellis per quæ derivantur Fluviorum aquæ*, &c. He found, from a great number of experiments, that if A be the aperture of the orifice, and D its depth below the surface of the reservoir, the quantity of water discharged in a given time will be as $2\,AD \times \frac{0.571}{1.000}$, while it ought to be as $2\,AD$, if the velocity of the issuing fluid was equal to that acquired by falling through D. By adapting to a circular orifice through which the water escaped, a cylindrical tube of the same diameter, the Marquis found that the quantity discharged in a determinate time was considerably greater than when it issued from the circular orifice itself; and this happened whether the water descended perpendicularly or issued in a horizontal direction.

Daniel Bernouilli's theory of the motion of fluids. Born 1700. Died 1782.

15. Such was the state of hydrodynamics in 1738, when Daniel Bernouilli published his *Hydrodynamica, seu de viribus et motibus Fluidorum Commentarii*. His theory of the motion of fluids was founded on two suppositions, which appeared to him conformable to experience. He supposed that the surface of a fluid, contained in a vessel which was emptying itself by an orifice, remains always horizontal; and if the fluid mass is conceived to be divided into an infinite number of horizontal strata of the same bulk, that these strata remain contiguous to each other, and that all their points descend vertically, with velocities inversely proportional to their breadth, or to the horizontal sections of the reservoir. In order to determine the motion of each stratum, he employed the principle of the *conservatio viri-*

[1] See his principal work, entitled *La Misura dell' acque correnti.*

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Objected to by Maclaurin, Born 1698, died 1746; and John Bernouilli, Born 1667, died 1748.

16. The uncertainty of the principle employed by Daniel Bernouilli, which has never been demonstrated in a general manner, deprived his results of that confidence which they would otherwise have deserved; and rendered it desirable to have a theory more certain, and depending solely on the fundamental laws of mechanics. Maclaurin and John Bernouilli, who were of this opinion, resolved the problem by more direct methods, the one in his Fluxions, published in 1742; and the other in his *Hydraulica nunc primum detecta, et directe demonstrata ex principiis purè mechanicis*, which forms the fourth volume of his works. The method employed by Maclaurin has been thought not sufficiently rigorous; and that of John Bernouilli is, in the opinion of La Grange, defective in perspicuity and precision.

D'Alembert applies his principle of dynamics to the motion of fluids, Born 1717.

17. The theory of Daniel Bernouilli was opposed also by the celebrated D'Alembert. When generalising James Bernouilli's Theory of Pendulums, he discovered a principle of dynamics so simple and general, that it reduced the laws of the motions of bodies to that of their equilibrium. He applied this principle to the motion of fluids, and gave a specimen of its application at the end of his Dynamics in 1743. It was more fully developed in his *Traité des Fluides*, which was published in 1744, where he has resolved, in the most simple and elegant manner, all the problems which relate to the equilibrium and motion of fluids. He makes use of the very same suppositions as Daniel Bernouilli, though his calculus is established in a very different manner. He considers, at every instant, the actual motion of a stratum, as composed of a motion which it had in the preceding instant, and of a motion which it has lost. The laws of equilibrium between the motions lost, furnish him with equations which represent the motion of the fluid. Although the science of hydrodynamics had then made considerable progress, yet it was chiefly founded on hypothesis. It remained a desideratum to express by equations the motion of a particle of the fluid in any assigned direction. These equations were found by D'Alembert, from two principles, that a rectangular canal, taken in a mass of fluid in equilibrio, is itself in equilibrio; and that a portion of the fluid, in passing from one place to another, preserves the same volume when the fluid is incompressible, or dilates itself according to a given law when the fluid is elastic. His very ingenious method was published in 1752, in his *Essai sur la resistanee des fluides*. It was brought to perfection in his *Opuscules Mathématiques*, and has been adopted by the celebrated Euler.

Before the time of D'Alembert, it was the great object of philosophers to submit the motion of fluids to general formulæ, independent of all hypothesis. Their attempts, however, were altogether fruitless; for the method of fluxions, which produced such important changes in the physical sciences, was but a feeble auxiliary in the science of hydraulics. For the resolution of the questions concerning the motion of fluids, we are indebted to the method of partial differences, a new calculus, with which Euler enriched the sciences. This great discovery was first applied to the motion of water by the celebrated D'Alembert, and enabled both him and Euler to represent the theory of fluids in formulæ restricted by no particular hypothesis.

Experiments of Michelotti, A. D. 1764.

18. An immense number of experiments on the motion of water in pipes and canals was made by Professor Michelotti of Turin, at the expense of the sovereign. In these experiments the water issued from holes of different sizes, under pressures of from 5 to 22 feet, from a tower constructed of the finest masonry. Basins (one of which was 289 feet square) built of masonry, and lined with stucco, received the effluent water, which was conveyed in canals of brickwork, lined with stucco, of various forms and declivities. The whole of Michelotti's experiments were conducted with the utmost accuracy; and his results, which are in every respect entitled to our confidence, were published in 1774 in his *Sperienze Idrauliche*.

Of the Abbe Bossut.

19. The experiments of the Abbé Bossut, whose labours in this department of science have been very assiduous and successful, have, in as far as they coincide, afforded the same results as those of Michelotti. Though performed on a smaller scale, they are equally entitled to our confidence, and have the merit of being made in cases which are most likely to occur in practice. In order to determine what were the motions of the fluid particles in the interior of a vessel emptying itself by an orifice, M. Bossut employed a glass cylinder, to the bottom of which different adjutages were fitted; and he found that all the particles descend at first vertically, but that at a certain distance from the orifice they turn from their first direction towards the aperture. In consequence of these oblique motions, the fluid vein forms a kind of truncated conoid, whose greatest base is the orifice itself, having its altitude equal to the radius of the orifice, and its bases in the ratio of 3 to 2.—It appears also, from the experiments of Bossut, that when water issues through an orifice made in a thin plate, the expense of water, as deduced from theory, is to the real expense as 16 to 10, or as 8 to 5; and, when the fluid issues through an additional tube, two or three inches long, and follows the sides of the tube, as 16 to 13.—In analyzing the effects of friction, he found, 1. That small orifices gave less water in proportion than great ones, on account of friction; and, 2. That when the height of the reservoir was augmented, the contraction of the fluid vein was also increased, and the expense of water diminished; and by means of these two laws he was enabled to determine the quantity of water discharged, with all the precision he could wish. In his experiments on the motion of water in canals and tubes, he found that there was a sensible difference between the motion of water in the former and in the latter. Under the same height of reservoir, the same quantity of water always flows in a canal, whatever be its length and declivity; whereas, in a tube, a difference in length and declivity has a very considerable influence on the quantity of water discharged. According to the theory of the resistance of fluids, the impulse upon a plane surface is as the product of its area multiplied by the square of the fluid's velocity, and the square of the sine of the angle of incidence. The experiments of Bossut, made in conjunction with D'Alembert and Condorcet, prove, that this is sensibly true when the impulse is perpendicular; but that the aberrations from theory increase with the angle of impulsion. They found, that when the angle of impulsion was between 50° and 90°, the ordinary theory may be employed, that the resistances thus found will be a little less than they ought to be, and the more so as the angles recede from 90°. The attention of Bossut was directed to a variety of other interesting points, which we cannot stop to notice, but for which we must refer the reader to the works of that ingenious author.

Inquiries of Flaugergues concerning the oscillation of waves.

20. The oscillation of waves, which was first discussed by Sir Isaac Newton, and afterwards by D'Alembert, in the article *Ondes* in the French Encyclopædia, was now revived by M. Flaugergues, who attempted to overthrow the opinions of these philosophers. He maintained, that a wave is not the effect of a motion in the particles of water,

[1] The germ of Daniel Bernouilli's theory was first published in his memoir entitled *Theoria Nova de Motu Aquarum per Canales quocunque Fluentes*, which he had communicated to the Academy of St Petersburg as early as 1726.

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by which they rise and fall alternately, in a serpentine line, when moving from the centre where they commenced; but that it is a kind of intumescence, formed by a depression at the place where the impulse is first made, which propagates itself in a circular manner when removing from the point of impulse. A portion of the water, thus elevated, he imagines, flows from all sides into the hollow formed at the centre of impulse, so that the water being, as it were, heaped up, produces another intumescence, which propagates itself as formerly. From this theory M. Flaugergues concludes, and he has confirmed the conclusion by experiment, that all waves, whether great or small, have the same velocity.

And of M. de la Grange. Born 1730, died 1813.

21. This difficult subject has also been discussed by M. de la Grange, in his *Mécanique Analytique*. He found, that the velocity of waves, in a canal, is equal to that which a heavy body would acquire by falling through a height equal to half the depth of the water in the canal. If this depth, therefore, be one foot, the velocity of the waves will be 5.945 feet in a second; and if the depth is greater or less than this, their velocity will vary in the subduplicate ratio of the depth, provided it is not very considerable. If we suppose that, in the formation of waves, the water is agitated but to a very small depth, the theory of La Grange may be employed, whatever be the depth of the water and the figure of its bottom. This supposition, which is very plausible, when we consider the tenacity and adhesion of the particles of water, has also been confirmed by experience.

Experiments and theory of the Chevalier de Buat. A.D. 1779.

22. The most successful labourer in the science of hydrodynamics was the Chevalier Buat, engineer in ordinary to the King of France. Following in the steps of the Abbé Bossut, he prosecuted the inquiries of that philosopher with uncommon ingenuity; and in the year 1786, he published, in two volumes, his *Principes d'Hydraulique*,[1] which contains a satisfactory theory of the motion of fluids, founded solely upon experiments. The Chevalier du Buat considered, that if water were a perfect fluid, and the channels in which it flowed infinitely smooth, its motion would be continually accelerated, like that of bodies descending in an inclined plane. But as the motion of rivers is not continually accelerated, and soon arrives at a state of uniformity, it is evident that the viscidity of the water, and the friction of the channel in which it descends, must equal the accelerating force. M. Buat, therefore, assumes it as a proposition of fundamental importance, that when water flows in any channel or bed, the accelerating force, which obliges it to move, is equal to the sum of all the resistances which it meets with, whether they arise from its own viscidity or from the friction of its bed. This principle was employed by M. Buat, in the first edition of his work, which appeared in 1779; but the theory contained in that edition was founded on the experiments of others. He soon saw, however, that a theory so new, and leading to results so different from the ordinary theory, should be founded on new experiments more direct than the former, and he was employed in the performance of these from 1780 to 1783. The experiments of Bossut having been made only on pipes of a moderate declivity, M. Buat found it necessary to supply this defect. He used declivities of every kind, from the smallest to the greatest; and made his experiments upon channels, from a line and a half in diameter, to seven or eight square toises. All these experiments he arranged under some circumstances of resemblance, and produced the following proposition, which agrees in a most wonderful manner with the immense number of facts which he has brought together, viz.

$$V = \frac{307 \times \sqrt{d - 01}}{\sqrt{s} - L\sqrt{s + 1.6}} - 0.3 \times \overline{d - 0.1},$$

where d is the hydraulic mean depth, s the slope of the pipe, or of the surface of the current, and V the velocity with which the water issues.

Researches of M. Venturi. A.D. 1798.

23. M. Venturi, Professor of Natural Philosophy in the University of Modena, succeeded in bringing to light some curious facts respecting the motion of water, in his work on the "Lateral Communication of Motion in Fluids." He observed, that if a current of water is introduced with a certain velocity into a vessel filled with the same fluid at rest, and if this current passing through a portion of the fluid is received in a curvilineal channel, the bottom of which gradually rises till it passes over the rim of the vessel itself, it will carry along with it the fluid contained in the vessel; so that after a short time has elapsed, there remains only the portion of the fluid which was originally below the aperture at which the current entered. This phenomenon has been called by Venturi, the lateral communication of motion in fluids; and, by its assistance, he has explained many important facts in hydraulics. He has not attempted to explain this principle; but has shewn, that the mutual action of the fluid particles does not afford a satisfactory explanation of it. The work of Venturi contains many other interesting discussions, which are worthy of the attention of every reader.

Discoveries of Coulomb, A.D. 1800.

24. Although the Chevalier Buat had shown much sagacity in classifying the different kinds of resistances which are exhibited in the motion of fluids, yet it was reserved for Coulomb to express the sum of them by a rational function of the velocity. By a series of interesting experiments on the successive diminution of the oscillation of discs, arising from the resistance of the water in which they oscillated, he was led to the conclusion, that the pressure sustained by the moving disc is represented by two terms, one of which varies with the simple velocity, and the other with its square. When the motions are very slow, the part of the resistance proportional to the square of the velocity is insensible, and hence the resistance is proportional to the simple velocity. M. Coulomb found also, that the resistance is not perceptibly increased by increasing the depth of the oscillating disc in the fluid; and by coating the disc successively with fine and coarse sand, he found that the resistance arises solely from the mutual cohesion of the fluid particles, and from their adhering to the surface of the moving body.

Experiments of M. Girard.

25. The law of resistance discovered by Coulomb, was first applied to the determination of the velocity of running water by M. Girard, who considers the resistance as represented by a constant quantity, multiplied by the sum of the first and second powers of the velocity. He regards the water which moves over the wetted sides of the channel as at first retarded by its viscidity, and he concludes that the water will, from this cause, suffer a retardation proportional to the simple velocity. A second retardation, analogous to that of friction in solids, he ascribes to the roughness of the channel, and he represents it by the second power of the velocity, as it must be in the compound ratio of the force and the number of impulsions which the asperities receive in a given time. He then expresses the resistance due to cohesion by a constant quantity, to be determined experimentally, multiplied into the product of the velocity of the perimeter of the section of the fluid.

A.D. 1814.

26. The influence of heat in promoting fluidity was known to the ancients;[2] but M. Du Buat was the first person who investigated the subject experimentally. His results, however, were far from being satisfactory; and it was left to

[1] A third volume of this work was published in 1816, entitled *Principes d'Hydraulique et Pyrodynamique*, relating chiefly to the subject of heat and elastic fluids.

[2] Pliny, *Quæst. Nat.*

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M. Girard to ascertain the exact effect of temperature on the motion of water in capillary tubes. When the length of the capillary tube is great, the velocity is quadrupled by an increase of heat from 0° to 85° centig.; but when its length is small, a change of temperature exercises little or no influence on the velocity. He found also, that, in ordinary conduit pipes, a variation of temperature exercises scarcely any influence over the velocity.

Investigations of M. Prony, A.D. 1804.

27. The theory of running water was greatly advanced by the researches of M. Prony. From a collection of the best experiments by Couplet, Bossut, and Du Buat, he selected 82, of which 51 were made on the velocity of water in conduit pipes, and 31 on its velocity in open canals; and by discussing these on physical and mechanical principles, he succeeded in drawing up general formulæ, which afford a simple expression of the velocity of running water. The following is the formula for English feet, which answers both for pipes and canals:—

$$V = 0.1541131 + \sqrt{(0.023751 + 32806.6\,G)}$$

When we use this formula for canals, we must take $G = RI$, R being $= \frac{\omega}{\chi}$ and $I = \frac{\zeta}{\lambda}$, ω representing the area of the section of the pipe or canal, χ the perimeter of the section in contact with the water, ζ the difference of level between the two extremities of the pipe, and λ the length of the pipe or canal.

When the formula is applied to pipes, we must take $G = \frac{1}{4}DK$, D being the diameter of the pipe, and $K = \frac{H + \zeta}{\lambda}$, H being the height of the head of water above the superior orifice of the pipe.[1]

Researches of M. Eytelwein of Berlin, 1801.

28. M. Eytelwein of Berlin published, in 1801, a valuable compendium of Hydraulics, entitled *Handbuch der Mechanik und der Hydraulik*, which contains an account of many new and valuable experiments made by himself. His work is divided into 24 chapters, the most important of which are the 7th, which treats of the motion of water in rivers, and the 9th, which treats of the motion of water in pipes. He has shewn that the *mean velocity* of water in a second in a river or canal flowing in an equable channel, is $\frac{10}{11}$ths of a mean proportional between the fall in two English miles, and the hydraulic mean depth; and that the *superficial velocity* of a river is nearly a mean proportional between the hydraulic mean depth and the fall in two English miles. In treating of the motion of water in pipes, he obtains the following simple formula, which agrees wonderfully with experiment,

$$V = 50\sqrt{\left(\frac{dh}{l + 50\,d}\right)}$$

in which l is the length of the pipe, d the hydraulic mean depth, and h the height of the reservoir. The following are some of the other important results which are given in his work. The contraction of the fluid area is 0.64, the coefficient for additional pipes 0.65, the coefficient for a conical tube similar to the curve of contraction 0.98. For the whole velocity due to the height, the coefficient by its square must be multiplied by 8.0458. For an orifice, the coefficient must be multiplied by 7.8; for wide openings in bridges, sluices, &c. by 6.9; for short pipes 6.6; and for openings in sluices without side walls 5.1. Our author investigates the subject of the discharge of water by compound pipes, the motions of jets, and their impulses against plane and oblique surfaces, and he shews theoretically, that a water-wheel will have its effect a maximum when its circumference moves with half the velocity of the stream.

Mallet and Vici, A.D. 1809.

29. A series of interesting hydraulic experiments was made at Rome in 1809, by MM. Mallet and Vici.[2] They found that a pipe, whose gauge was *five ounces* French measure (or 0.03059 French kilolitres), furnished *one-seventh* more water than *five* pipes of *one* ounce, an effect arising from the velocity being diminished by friction in the ratio of the perimeters of the orifices as compared with their areas.

Researches of M. Poisson, 1816.

Notwithstanding the investigations of Newton, D'Alembert, and Lagrange, the problem of waves was still unsolved; and the Institute of France was induced to propose, as the subject of its annual prize for 1816, "The Theory of Waves on the surface of a heavy Fluid of indefinite depth." M. Poisson had previously studied this difficult subject, and he lodged his first memoir in the bureau of the Institute on the 2d October 1815, at the expiration of the period allowed for competition. M. Poisson supposes the waves to be produced in the following manner. A body of the form of an elliptic paraboloid is immersed a little in the fluid, with its axis vertical and its vertex downwards. After being left in this position till the equilibrium of the fluid is restored, the body is suddenly withdrawn, and waves are formed round the place which it occupied. This first memoir contains the general formula for waves propagated with an uniformly accelerated motion; but in a second memoir, read in December, he gives the theory of waves propagated with a constant velocity. This last class of waves are much more sensible than the first, and are those which are seen to spread in circles round any disturbance made at the surface of water. In determining the superficial as well as the internal propagation of these waves, he considers only the case when the disturbance of the water is so small, that the second and the higher powers of the velocity of the oscillating particles may be neglected; and he assumes, that a fluid particle which is at any instant at the surface, continues there during the whole of the motion, a supposition which the condition of the continuity of the fluid renders necessary. He supposes the depth of the water constant throughout its whole extent, the bottom being considered as a fixed horizontal plane at a given distance beneath its natural surface. He then treats, *first*, the case in which the motion takes place in a canal of uniform width, over which obstruction is made of the horizontal dimension of the fluid; and, *secondly*, the case in which the fluid is considered in its true dimensions.

Researches of M. Cauchy, 1816.

30. The prize offered by the Institute was gained by M. Augustin Louis Cauchy, then a young mathematician of the highest promise. In his memoir, which was published in the 3d volume of the *Mémoires des Sçavans*, he treats only of the first kind of waves above mentioned; and his investigation claims to be more complete than that in the first memoir of Poisson, in so far as it leaves entirely arbitrary the form of the function relative to the initial form of the fluid surface, and, therefore, allows the analysis to be applied when bodies of different forms are used to produce the initial disturbance. From his analysis, M. Cauchy concludes, "that the heights and velocities of the different waves produced by the immersion of a cylindrical or prismatic body, depend not only on the width and height of the part immersed, but also on the form of the surface which bounds this part." He is also of opinion, that the number of the waves produced may depend on the form of the immersed body, and the depth of immersion.

Results of theory respecting waves.

31. The following abstract of the principal results obtained by theory, respecting the nature of waves, has been given by Mr Challis:—

"With respect first to the canal of uniform width, the law of the velocity of propagation found by Lagrange, is

[1] See Prony's *Recherches Physico-mathématiques sur la Théorie des Eaux Courantes*.

[2] See Mallet, *Notices Historiques*; Paris, 1830.

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confirmed by Poisson's theory when the depth is small, but not otherwise.

"When the canal is of unlimited depth, the following are the chief results.

"1. An impulse given to any point of the surface, affects instantaneously the whole extent of the fluid mass.

"The theory determines the magnitude and direction of the initial velocity of each particle resulting from a given impulse.

"2. The summit of each wave moves with a uniformly accelerated motion.

"This must be understood to refer to a series of very small waves, called by M. Poisson *dents*, which perform their movements, as it were, on the surface of the larger waves, which he calls '*les ondes dentelées*.' Each wave of the series is found to have its proper velocity, independent of the primitive impulse.

"3. At considerable distances from the place of disturbance, there are waves of much more sensible magnitude than the preceding.

"Their summits are propagated with a uniform velocity, which varies as the square root of the breadth *à fleur d'eau* of the fluid originally disturbed. Yet the different waves which are formed in succession, are propagated with different velocities: the foremost travels swiftest. The amplitudes of oscillations of equal duration, are reciprocally proportional to the square root of the distances from the point of disturbance.

"4. The vertical excursions of the particles situated directly below the primitive impulse, vary according to the inverse ratio of the depth below the surface. This law of decrease is not so rapid but that the motion will be very sensible at very considerable depths: it will not be the true law, as the theory proves, when the original disturbance extends over the whole surface of the water, for the decrease of motion in this case will be much more rapid.

"The results of the theory, when the three dimensions of the fluid are considered, are analogous to the preceding 1, 2, 3, 4, and may be stated in the same terms, excepting that the amplitudes of the oscillations are inversely *as the distances* from the origin of disturbance, and the vertical excursions of the particles situated directly below the disturbance, vary inversely as the *square* of the depth."

Experiments of Weber and Bidone, 1825.

32. Several very interesting experiments on the propagation of waves, have been made by M. Weber and by M. Bidone. Although Weber's[1] experiments were not made in exact conformity with the condition which the theory required, yet they, generally speaking, harmonize with it; and they particularly establish the existence of the small accelerated waves near the place of disturbance, and of a perceptible motion of the particles of the fluid at considerable depths below the surface. When an elliptic paraboloid is used to produce the waves, with its axis vertical, and its vertex downwards, and when, of course, the section of the solid in the plane of the surface of the water is an ellipse, the velocity of propagation is, according to the theory, greater in the direction of the major axis than in that of the minor, in the ratio of the square root of the one to the square root of the other; but this result is not confirmed by Weber's experiments.

M. Bidone of Turin[2] has made experiments on waves more conformable to the condition of the theory, and he has in a great measure removed the obstacle arising from the adhesion of the water to the immersed body; and the experiments which he has thus made, confirm the laws of motion, as well as the existence of accelerated waves.

Investigations of M. Bidone, 1826–7.

33. In 1826, M. Bidone made a series of experiments on the velocity of running water at the hydraulic establishment of the University of Turin, and he published an account of them in 1829.[3] After giving a description of his apparatus and method of experimenting, he gives the figures obtained from fluid veins, discharged from rectilineal and curvilineal orifices with salient angles pierced in vertical plates, and whose perimeters are formed of straight and curve lines, varying in more than fifty different ways, with variable and invariable changes from zero to 22 French feet, the area of the water being equal to one square inch. The sections of the veins were taken at different distances from the orifice, and the results, which are extremely curious, are illustrated by diagrams.

In a subsequent memoir, M. Bidone gives a theoretical view of his experiments. He considers the greatest contraction of the fluid vein to take place at a distance not more than the greatest diameter of the orifice, whatever be its shape; and hence it follows, that the discharge from the orifice is equal to the sum of the product of each superficial element, multiplied by the velocity of the fluid vein; and since the area of the vena contracta was found to be from 0.60 to 0.62, the expenditure will be represented by the product of this coefficient of contraction, and the velocity due to the charge.

In the case of a fluid vein issuing from a small orifice relative to the section of the vessel, and reduced to a state of permanence, he finds that the area of the section of the vena contracta depends solely on the direction, and not on the velocity, of its component filaments; a result which experiment confirms. M. Bidone next ascertains that, in a circular orifice, the absolute diameter of the vena contracta is exactly two-thirds of that of the orifice, the correction which is due to the contraction depending on the adhesion and friction of the fluid against the perimeter of the orifice, and the ratio of the area of the vein to the area of the orifice; the same being true for all orifices.

Experiments of General Sabatier, 1827.

34. A series of useful experiments was made in 1827, under the sanction of the French government, by General Sabatier, Commandant of the Military School at Metz. The apparatus which he used consisted of *four* basins. The *first* had an area of 25,000 square metres: the *second* had an area of only 1500 square metres, and a depth of 3.70 metres, and was so contrived by means of sluices, as to have a complete command of the level of the water during the experiment: the *third* basin, which communicated directly with the second basin, was 3.68 metres long and 3 wide, to receive the water discharged by the orifices: and the *fourth* basin was a gauge capable of containing 24,000 litres. In carrying on the experiments, the opening of the orifices, the height or charge of the fluid in the reservoir, as well as the level of the water in the gauge basin relative to each discharge of fluid, were measured to the tenth of a millimetre, so that the approximation was at least $\frac{1}{200}$dth of the whole result.

The following are some of the principal results of these experiments.

1. For complete orifices of 20 centimetres square and high charges, the coefficient is 0.600. When the charge is 4 or 5 times the opening of the orifice, the coefficient becomes 0.605, but beyond that charge the coefficient diminishes to 0.593.

2. The same law takes place for 10 and 5 centimetres in height, the coefficients being for 10 centimetres 0.611, 0.618, 0.611, respectively, and for 5 centimetres in height 0.618, 0.631, 0.623.

3. With orifices of 3, 2, and 1, centimetres in height, the law changes rapidly, and the coefficients increase as the opening of the orifice diminishes, being for 1 centimetre, the smallest height of the orifice, 0.698 to 0.640 for 3 centimetres.

Mr George Rennie, 1830.

35. In the year 1830, Mr George Rennie undertook a series

[1] *Wellenlehre auf Experimente gegrundet.* Leipzig, 1825.

[2] *Turin Memoirs*, vol. xxv.

[3] *Expériences sur la forme et sur la direction des Veines et des Courans d'Eau, lancés par diverses ouvertures.*

of experiments on the friction of water against revolving cylinders and discs, on the direct resistances to globes and discs revolving in air and water alternately, on the coefficients of contraction, and on the expenditure of water through orifices, additional tubes, and pipes of different lengths. The following are some of his principal results.

1. It appears from his first series of experiments, that, with slow velocities, the friction varies with the surfaces; that an increase of surface did not materially affect the friction with increased velocities; and that, with equal surfaces, the resistances approximated to the squares of the velocities.

2. In the experiments on the resistances experienced by globes and discs revolving in air and water alternately, it appears that the resistances in both cases were as the squares of the velocities, and that the mean resistances were as follows:

		Resist. in Air.	Resist. in Water.
Circular discs,	.	25.180	1.18
Square plates,	.	22.010	1.36
Round globes,	.	10.627	0.75

3. In circular orifices in brass plates, $\frac{1}{66}$th of an inch thick, and with apertures of $\frac{1}{4}$, $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{1}$ of an inch respectively, under pressures from 1 to 4 feet, the coefficients were—

		Coefficient of contraction.
For altitudes of 1 foot,	.	0.619
.... 4 feet,	.	0.621

For additional tubes of glass, they were—

		Coefficient.
For altitudes of 1 foot,	.	0.817
.... 4 feet,	.	0.806

4. The expenditure through orifices, additional tubes, and pipes of different lengths, of equal areas, and the same kind of water, as compared with the expenditure through a pipe 30 feet long, are—

For orifices,	.	.	3 to 1
For additional tubes,	.	.	4 to 1
For a pipe 1 foot long,	.	.	3.7 to 1
.... 2 feet long,	.	.	1.4 to 1
.... 4 feet long,	.	.	2.0 to 1
.... 8 feet long,	.	.	2.6 to 1

5. With bent rectangular pipes, half an inch in diameter, and 15 feet long, the expenditure was diminished two-thirds; with 14 bends as compared with a straight pipe, and with 24 bends, one-third; but it did not seem to follow any law.

Experiments of Mr Jardine.

36. Many very accurate experiments on the discharge of water from long pipes, were made by James Jardine, Esq. civil-engineer. In the case of the Comiston Main, which conducts the water from the reservoir at Comiston to the Castle at Edinburgh, the length of the pipe is 14,930 feet, its diameter $4\frac{1}{2}$ inches, the altitude 51 feet, and the quantity of water actually delivered 189.4 Scots pints. This valuable result Mr Jardine compared with the different formulæ as follows:

		Scots pints.
Actual delivery of water at Comiston Main,	.	189.4
Calculated do. by Eytelwein's formula,	.	189.77
Do. by Gerard's formula,	.	188.26
Do. by Dubuat's formula,	.	188.13
Do. by Prony's simple formula,	.	182.32
Do. by Prony's tables,	. .	180.7

Improvement in theory of fluids by Mr Airy, 1830.

37. An improvement on the common theory of fluids was lately suggested by Professor Airy, in his lectures at Cambridge. It had been usual to assume the law of equal pressure as a datum of observation. Professor Airy, however, has shewn that this property may be deduced from another more simple and equally given by observation; namely, that the division of a perfect fluid may be effected without the application of sensible force; and hence, it immediately follows, that the state of equilibrium or motion of a mass of fluid, is not altered by a mere separation of its parts by an indefinitely thin partition. Professor Miller has given a definition of fluids founded on this principle, and a proof of the law of equal pressure, at the beginning of his *Elements of Hydrostatics*, &c. published at Cambridge in 1831. Dr Thomas Young had employed an equivalent principle to that of Mr Airy in determining the manner of the reflection of waves of water;[1] and Mr Challis considers it as necessary in the solution of some hydrostatical and hydrodynamical problems.

Researches of Prof. Mosely, 1830.

38. There are certain cases in the analytical theory of hydrodynamics which require a more simple analysis than others; such, for example, as those of *steady* motion, or of motion which has arrived at a permanent state, so that the velocity is constant in quantity and direction at the same point. Equations applicable to this kind of motion seem to have been first given by Professor Mosely, in his *Elementary Treatise on Hydrostatics and Hydrodynamics.* The following is the principle from which he has derived them. *When the motion is steady, each particle, in passing from one point to another, passes successively through the states of motion of all the particles which at any instant lie in its path.* This general principle is applicable to all kinds of fluids, and is true, whether or not the effect of heat is taken into account, provided the condition of steadiness remains. As it enables us to consider the motion of a single particle in place of that of a number, it readily affords the equations of motion.

Researches of Mr Challis.

39. As it was desirable to know how the same equation might be obtained from the general equations of fluid motion, Mr Challis undertook this inquiry, and published the results of it in the *Transactions of the Cambridge Philosophical Society.*[2] In this paper, he has given a method of doing this both for incompressible and elastic fluids, and he has shewn that a term in the general formulæ which occasions the complexity in most hydrodynamical questions, disappears in cases of steady motion. Mr Challis is of opinion, that these equations may be employed in very interesting researches, and he mentions, as instances, the motion of the atmosphere as affected by the rotation of the earth, and a given distribution of temperature due to solar heat.

Experiments of Eytelwein and others.

40. The science of hydrodynamics has of late years been cultivated by M. Eytelwein of Berlin, whose practical conclusions coincide nearly with those of Bossut; by Dr Matthew Young, late Bishop of Clonfert, who has explained the cause of the increased velocity of efflux through additional tubes; and by Mr Vince, Dr T. Young, Coulomb, and Don George Juan; but the limits of this work will not permit us to give any further account of their labours at present. We must now proceed to initiate the reader into the science itself, beginning with that branch of it which relates to the pressure, equilibrium, and cohesion of nonelastic fluids.

[1] *Nat. Phil.* vol. ii. p. 64.

[2] Vol. iii. Part iv.

PART I.—HYDROSTATICS.

Hydrostatics.

Definition of hydrostatics.

41. Hydrostatics is that branch of the science of hydrodynamics which comprehends the pressure and equilibrium of non-elastic fluids, as water, oil, mercury, &c.; the method of determining the specific gravities of substances, the equilibrium of floating bodies, and the phenomena of capillary attraction.

DEFINITIONS AND PRELIMINARY OBSERVATIONS.

Definition of a fluid.

42. A fluid is a collection of very minute particles, cohering so little among themselves, that they yield to the smallest force, and are easily moved among one another.

Perfect fluids.

Imperfect fluids.

43. Fluids have been divided into *perfect* and *imperfect.* In perfect fluids the constituent particles are supposed to be endowed with no cohesive force, and to be moved among one another by a pressure infinitely small. But, in imperfect or viscous fluids, the mutual cohesion of their particles is very sensible, as in oil, varnish, melted glass, &c.; and this tenacity prevents them from yielding to the smallest pressure. Although water, mercury, alcohol, &c. have been classed among perfect fluids, yet it is evident that neither these nor any other liquid is possessed of perfect fluidity. When a glass vessel is filled with water above the brim, it assumes a convex surface; and when a quantity of it is thrown on the floor, it is dispersed into a variety of little globules, which can scarcely be separated from one another. Even mercury, the most perfect of all the fluids, is endowed with such a cohesive force among its particles, that if a glass tube, with a small bore, is immersed in a vessel full of this fluid, the mercury will be lower in the tube than the surface of the surrounding fluid;—if a small quantity of it be put in a glass vessel, with a gentle rising in the middle of its bottom, the mercury will desert the middle, and form itself into a ring, considerably rounded at the edges; or if several drops of mercury be placed upon a piece of flat glass, they will assume a spherical form; and if brought within certain limits, they will conglobulate and form a single drop. Now, all these phenomena concur to prove, that the particles of water have a mutual attraction for each other; that the particles of mercury have a greater attraction for one another, than for the particles of glass; and, consequently, that these substances are not entitled to the appellation of perfect fluids.

Florentine experiment.

Compressibility of water first noticed by Lord Bacon.

44. It was universally believed, till within the last seventy years, that water, mercury, and other fluids of a similar kind, could not be made to occupy a smaller space, by the application of any external force. This opinion was founded on an experiment made by Lord Bacon, who inclosed a quantity of water in a leaden globe, and by applying a great force attempted to compress the water into a less space than it occupied at first: The water, however, made its way through the pores of the metal, and stood on its surface like dew. The same experiment was afterwards repeated at Florence by the Academy del Cimento, who filled a silver globe with water, and hammered it with such force as to alter its form, and drive the water through the pores of the metal. Though these experiments were generally reckoned decisive proofs of incompressibility, yet Bacon himself seems to have drawn from his experiment a very different conclusion; for after giving an account of it, he immediately adds, that *he computed into how much less space the water was driven by this violent pressure.*[1] This passage from Lord Bacon does not seem to have been noticed by any writer on hydrostatics, and appears a complete proof that the compressibility of water was fairly deducible from the issue of his experiment. In consequence of the reliance which was universally placed on the result of the Florentine experiment, fluids have generally been divided into *compressible* and *incompressible,* or *elastic* and *non-elastic fluids:* water, oil, alcohol, and mercury, being regarded as incompressible and non-elastic; and air, steam, and other aëriform fluids, as compressible or elastic.

Fluids divided into compressible and incompressible.

Compressibility of water ascertained by Mr Canton,

45. About the year 1761, the ingenious Mr Canton began to consider this subject with attention, and distrusting the result obtained by the Academy del Cimento, resolved to bring the question to a decisive issue.[2] Having procured a small glass tube, about two feet long, with a ball at one end, an inch and a quarter in diameter, he filled the ball and part of the tube with mercury, and brought it to the temperature of 50° of Fahrenheit. The mercury then stood six inches and a half above the ball; but after it had been raised to the top of the tube by heat, and the tube sealed hermetically, then, upon bringing the mercury to its former temperature of 50°, it stood $\frac{32}{100}$th of an inch higher in the tube than it did before. By repeating the same experiment with water exhausted of air, instead of mercury, the water stood $\frac{43}{100}$th of an inch higher in the tube than it did at first. Hence, it is evident, that when the weight of the atmosphere was removed, the water and mercury expanded, and that the water expanded $\frac{11}{100}$th of an inch more than the mercury. By placing the apparatus in the receiver of a condensing engine, and condensing the air in the receiver, he increased the pressure upon the water, and found that it descended in the tube. Having thus ascertained the fact, that water and mercury are compressible, he subjected other fluids to similar experiments, and obtained the results in the following table:

	Millionth Parts.	Specific Gravity.
Compression of Mercury,..........	3	13.595
Sea-Water,........	40	1.028
Rain-Water,......	46	1.000
Oil of Olives,.....	48	0.918
Spirit of Wine,...	66	0.846

Lest it should be imagined that this small degree of compressibility arose from air imprisoned in the water, Mr Canton made the experiment on some water which had imbibed a considerable quantity of air, and found that its compressibility was not in the least augmented. By inspecting the preceding table, it will be seen that the compressibility of the different fluids is nearly in the inverse ratio of their specific gravities.

and confirmed by Zimmerman.

46. The experiments of Mr Canton have been lately confirmed by Professor Zimmerman. He found that sea-water was compressed $\frac{1}{340}$th part of its bulk, when inclosed in the cavity of a strong iron cylinder, and under the influence of a force equal to a column of sea-water 1000 feet in height. From these facts, it is obvious that fluids are susceptible of contraction and dilatation, and that there is no foundation in nature for their being divided into compressible and incompressible. If fluids are compressible, they will also be elastic; for when the compressing force is removed, they will recover their former magnitude; and

[1] *Bacon's Works,* by Shaw, vol. ii. p. 521; *Novum Organum,* part. ii. sect. 2. alph. 45. § 222.

[2] See the *Philosophical Transactions* for 1762 and 1764, vols. lii. and liv.

Pressure, &c. of fluids.

hence their division into elastic and non-elastic is equally improper.

Experiments of Professor Oersted.

A series of very valuable experiments on the compressibility of water has recently been made by Professor Oersted of Copenhagen. At the temperature at which water has a maximum density, which, according to Professor Stampfer of Vienna, is at 38° 75 of Fahrenheit, Professor Oersted found the *true* compressibility of water by one atmosphere (or 336 French lines of mercury) to be 46.1 millionths of the volume, the difference between the true and the apparent compressibility arising from the effect of the heat developed by the compression, by which the liquid and the bottle are dilated. He found also that the differences of volume in the compressed water are proportional to the compressing power; and that this law holds as far as the pressure of 65 atmospheres, and probably much farther; but how far he was not able to determine, as his apparatus could not resist a greater pressure.

Experiments of Mr Perkins.

A series of interesting experiments at high pressures were made by Mr Perkins, who has described the instrument which he employed in the *Philosophical Transactions* for 1826, p. 541. The following table contains the results which he obtained from 10 to 2000 atmospheres upon a column of water 190 inches long:

Pressure, &c. of Fluids.

No. of Atmospheres.	Compression. Inch.	No. of Atmospheres.	Compression. Inch.	No. of Atmospheres.	Compression. Inch.
10	0.189	80	1.187	500	5.087
20	0.372	90	1.288	600	5.907
30	0.547	100	1.422	700	6.715
40	0.691	150	1.914	800	7.402
50	0.812	200	2.440	900	8.243
60	0.756	300	3.339	1000	9.002
70	1.056	400	4.193	2000	15.833

If the number of atmospheres are made the abscissa of a curve, and the compressions its ordinates, it will be seen that the curve approximates to a hyperbolic one.

47. The doctrines of hydrostatics have been deduced by different philosophers from different properties of fluids. Euler has founded his analysis on the following property, "that when fluids are subjected to any pressure, that pressure is so diffused throughout the mass, that when it remains in equilibrio all its parts are equally pressed in every direction."[1] D'Alembert at first[2] deduced the principles of hydrostatics from the property which fluids have of rising to the same altitude in any number of communicating vessels; but he afterwards[3] adopted the same property as Euler from the foundation which it furnishes for an algebraical calculus. The same property has been employed by Bossut, Prony, and other writers, and will form the first proposition of the following chapter.

CHAPTER I.—ON THE PRESSURE AND EQUILIBRIUM OF FLUIDS.

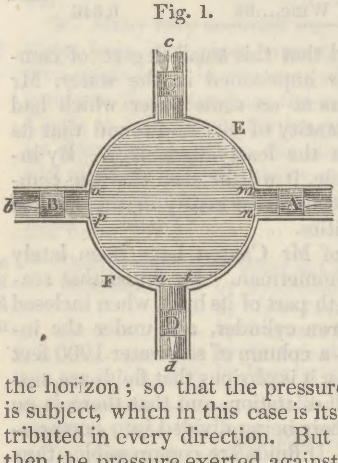
Proposition I.

48. When a mass of fluid, supposed without weight, is subjected to any pressure, that pressure is so diffused throughout the whole, that when it remains in equilibrio all its parts are equally pressed in every direction.

The parts of a fluid subjected to any pressure, are equally pressed in every direction.

As it is the distinguishing property of fluids that their particles yield to the smallest pressure, and are easily moved among themselves (26.), it necessarily follows, that if any particle is more pressed towards one side than towards another, it will move to that side where the pressure is least; and the equilibrium of the fluid mass will be instantly destroyed. But by the hypothesis the fluid is in equilibrio, consequently the particle cannot move towards one side, and must therefore be equally pressed in every direction.

Fig. 1.



In order to illustrate this general law, let EF (fig. 1.) be a vessel full of any liquid, and let *mn*, *op* be two orifices at equal depths below its surface; then, in order to prevent the water from escaping, it will be necessary to apply two pistons, A and B, to the orifices *mn*, *op* with the same force, whether the orifice be horizontal or vertical, or in any degree inclined to the horizon; so that the pressure to which the fluid mass is subject, which in this case is its own gravity, must be distributed in every direction. But if the fluid has no weight, then the pressure exerted against the fluid at the orifice *op*, by means of the piston B, will propagate itself through every part of the circular vessel EF, so that if the orifices *mn*, *tu* are shut, and *rs* open, the fluid would rush through this aperture, in the same manner as it would rush through *mn* or *tu*, were all the other orifices shut. This proposition, however, is true only in the case of perfect fluids; for when there is a sensible cohesion between the particles, as in water, an equilibrium may exist even when a particle is less pressed in one direction than in another; but this inequality of pressure is so exceedingly trifling, that the proposition may be considered as true, even in cases of imperfect fluidity.

Prop. II.

49. If to the equal orifices *mn*, *tu*, *op*, *rs* of a vessel, containing a fluid destitute of weight, be applied equal powers A, B, C, D, in a perpendicular direction, or if the orifices *mn*, &c. be unequal, and the powers A, B, &c. which are respectively applied to them be proportional to the orifices, these powers will be in equilibro. Fig. 1.

It is evident from the last proposition, that the pressure exerted by the power B is transmitted equally to the orifices *mn*, *rs*, *tu*, that the pressure of the power C is transmitted equally to the orifices *mn*, *op*, *tu*, and so on with all other powers. Every orifice then is influenced with the same pressure, and, consequently, none of the powers A, B, C, D, can yield to the action of the rest. The fluid mass, therefore, will neither change its form nor its situation, and the powers A, B, C, D will be in equilibro. If the powers A, B, C, D are not equal to one another, nor the orifices *mn*, *op*, *rs*, *tu*; but if $A : B = mn : op$, and so on with the rest, the fluid will still be in equilibrio. Let A be greater than B, then *mn* will be greater than *op*; and whatever number of times B is contained in A, so many times will *op* be contained in *mn*. If $A = 2B$, then $mn = 2\,op$, and since the orifice *mn* is double of *op*, the pressure upon it must also be double; and, in order to resist that pressure, the power A must also be double of B;

[1] *Nov. Comment. Petropol.* tom. xiii. p. 305.

[5] *Traité des Fluides*, § 20.

[2] *Mélanges de Littéarture, d'Histoire, et Philosophie.*

Pressure, &c. of Fluids.

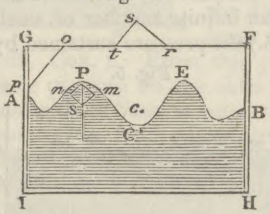
but, by hypothesis, A = 2 B, consequently the pressures upon the orifices, or the powers A, B, will be in equilibrio. If the power A is any other multiple of B, it may be shewn in the same way that the fluid will be in equilibrio.

Prop. III.

50. The surface of a fluid, influenced by the force of gravity and in equilibrio in any vessel, is horizontal, or at right angles to the direction of gravity.

The surface of fluids horizontal.

Fig. 2.



Let the surface of the fluid be supposed to assume the waving form APEB. Any particle P in the surface of the fluid is influenced by the force of gravity, which may be represented by PS, and which may be decomposed into two forces P*m*, P*n* in the direction of the two elementary portions of the surface P*m*, P*n* (see Article Dynamics). But since the particle P is in a state of equilibrium, the force of gravity acting in the direction P*m*, P*n* must be destroyed by equal and opposite forces, exerted by the neighbouring particles against P in the direction *m*P, *n*P; therefore the forces P*m*, P*n* are equal to the forces *m*P, *n*P. Now the particle P being in equilibrio, must be equally pressed in every direction (48). Wherefore the forces P*m*, P*n* are equal, and by the doctrine of the composition of forces (see Article Dynamics), the angle *m* P*n* formed by the two elementary portions P*m*, P*n* of the surface of the fluid, must be bisected by PS, the line which represents the direction of gravity. The same may be proved of every other point of the surface of the fluid; and therefore this surface must be horizontal or perpendicular to the direction of gravity.

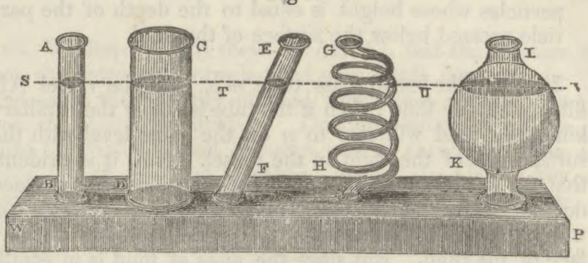
51. This proposition may be otherwise demonstrated. From the principles of mechanics, it is obvious, that when the centre of gravity of any body is at rest, the body itself is at rest; and that when this centre is not supported, the body itself will descend, till it is prevented by some obstacle from getting farther. In the same manner the centre of gravity of a fluid mass will descend to the lowest point possible; and it can be shewn that this centre will be in its lowest position only when the surface of the fluid mass is horizontal. For let FGHI (fig. 2) be any surface, whether solid or fluid, and C its centre of gravity, the point C is nearer the line HI when FG is parallel to HI and rectilineal, than when it has any other form or position. When the surface FGHI is suspended by the point C, or balanced upon it, it will be in equilibrio; but if the line FG is made to assume any other form as F*rstop*, by removing the portion G*op* of the surface to *rst*, the equilibrium, will be destroyed, and the side FG will preponderate. In order, therefore, to restore the equilibrium, the surface must be balanced on a point *c* farther from HI; that is, the centre of gravity of the surface F*rstop*IH is *c*. In the same way it may be shewn, that whatever be the form of the bounding line FG, the quantity of surface remaining the same, its centre of gravity will be nearest HI, when FG is rectilineal and parallel to it. On the truth contained in this proposition depends the art of levelling, and the construction of the spirit level, for an account of which see Levelling.

52. As the direction of gravity is in lines which meet near the centre of the earth; and as it appears from this proposition, that the surface of fluids is perpendicular to that direction, their surface will be a portion of a spheroid similar to the earth. When the surface has no great extent, it may be safely considered as a plane; but when it is pretty large, the curvature of the earth must be taken into account.

Prop. IV.

53. The surface of a fluid influenced by the force of gravity, and contained in any number of communicating vessels, however different in form and position, will be horizontal.

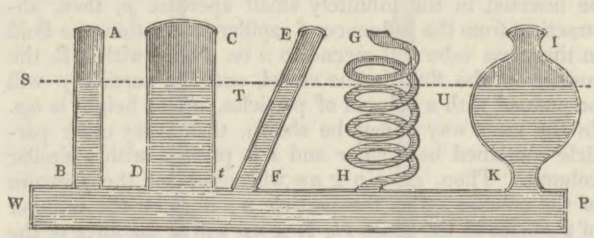
Fig 3.



The surface of a fluid in any number of communicating vessels is horizontal.

Let AB, CD, EF, GH, IK, be a system of communicating vessels into which a quantity of fluid is conveyed: It will rise to the same height in each vessel, and have a horizontal surface. Suppose ABEF, fig. 4, a vessel full of water. By the last proposition, its surface ST will be horizontal. Now, if any body be plunged into this vessel, the cylinder AD for instance, the surface of the fluid will still be horizontal; for no reason could be assigned for the water's rising on one side of this body any more than on another. Let us now immerge into the fluid, successively, the solid bodies AD, CE*t*, GHF, &c., then after each immersion the surface will still be horizontal; and when all these solids are immerged, the large vessel ABFE will be converted into the system of communicating vessels represented in fig. 4, in which the surface of the fluid will, of consequence, be horizontal.

Fig. 4.



54. This proposition may be also demonstrated by supposing the parts AD, CE*t*, GHF, &c. converted into ice without changing their former magnitude. When this happens, the equilibrium will not be disturbed; and the fluid mass AF, whose surface was proved to be horizontal by the last proposition, will continue in the same state after the congelation of some of its parts. That is, the surface of the fluid in the communicating vessels will be horizontal.

This proposition is not true when the communicating vessels are capillary tubes.

55. When the communicating vessels are so small that they may be regarded as capillary tubes, the surface of the fluid will not be horizontal. From the attraction which all fluids have for glass, they rise to a greater height in smaller tubes than in larger ones, and the quantity of elevation is in the inverse ratio of the diameters of the bores. In the case of mercury, and probably of melted metals, the fluid substance is depressed in capillary tubes, and the depression is subject to the same law. The subject of capillary attraction will be treated at length in a subsequent part of this article.

56. This proposition explains the reason why the surface of small pools in the vicinity of rivers is always on

Pressure, &c. of Fluids.

a level with the surface of the rivers themselves, when there is any subterraneous communication between the river and the pool. The river and the pool may be considered as communicating vessels.

Prop. V.

57. If a mass of fluid contained in a vessel be in equilibrio, any particle whatever is equally pressed in every direction, with a force equal to the weight of a column of particles whose height is equal to the depth of the particle pressed below the surface of the fluid.

Fig. 5.

Immerse the small glass-tube *mp*, into the vessel AB filled with any fluid; then if the tube is not of the capillary kind, the fluid will rise to *n* on the same level with the surface AB of the fluid in the vessel. Now it is evident, that the particle *p* at the bottom of the tube *mp* is pressed downwards by the superincumbent column of particles *np*, which is equal to the depth of the particle *p* below the surface of the fluid. But since the mass of fluid is in equilibrio, the particle *p* is pressed equally in every direction: Therefore, the particle *p* is pressed equally in every direction by a force equal to the superincumbent column *np*.

Prop. VI.

58. A very small portion of a vessel of any form, filled with a fluid, is pressed with a force which is in the compound ratio of the number of particles contained in that surface, its depth below the surface of the fluid, and the specific gravity of the fluid.

Fig. 5.

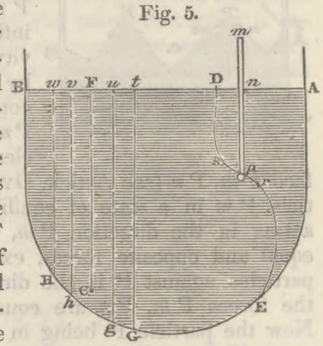
Let D*p* EB be the vessel, and *rs* a very small portion of its surface, the pressure upon *rs* is in the compound ratio of the number of particles in *rs*, and *np* its depth below the horizontal surface DB. Suppose the glass tube *mp* to be inserted in the infinitely small aperture *p*, then, abstracting from the influence of capillary attraction, the fluid in the glass tube will ascend to *n* on a level with DB, the surface of the fluid in the vessel, and the particle *p* will be pressed with a column of particles, whose height is *np*. In the same way it may be shewn, that every other particle contained between *r* and *s* is pressed with a similar column. Then, since $p \times np$ will represent the pressure of the column *np* on the particle *p*; if N be the number of particles in the space *rs*, $N \times np$ will be the force of the column supported by the space *rs*. And as the weight of this column must increase with the specific gravity of the fluid, $S \times N \times np$ will represent its pressure, S being the specific gravity of the fluid.

Prop. VII.

59. The pressure upon a given portion of the bottom of a vessel, whether plane or curved, filled with any fluid, is in the compound ratio of the area of that portion, and the *mean altitude* of the fluid, that is, the perpendicular distance of the centre of gravity of the given portion from the surface of the fluid; or, in other words, the pressure is equal to the weight of a column of fluid whose base is equal to the area of the given portion, and whose altitude is the mean altitude of the fluid.

Let AEGB be the vessel, and AFB the surface of the fluid which it contains. Let GH be a given portion of its bottom, and C the centre of gravity of that portion: Then shall CF be the mean altitude of the fluid. For, conceive the portion GH to be divided into an infinite number of small elements H*h*, G*g*, &c. then (58.) the pressure sustained by the elements H*h*, G*g*, will be respectively $S \times Hh \times Hw$; $S \times Gg \times Gt$, &c. the specific gravity of the fluid being called S. But it follows from the nature of the centre of gravity, that the sum of all these products is equal to the product of the whole portion GH into CF the distance of its centre of gravity from the horizontal surface of the fluid.[1] Therefore the pressure upon the portion GH is in the compound ratio of its surface converted into a plane, and the mean altitude of the fluid.

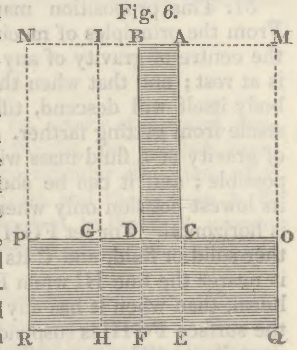
Fig. 5.



Hydrostatic paradox.

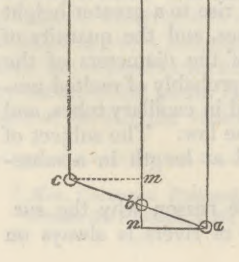
60. From this proposition we may deduce what is generally called the *Hydrostatic paradox*, viz. that *the pressure upon the bottoms of vessels filled with fluid does not depend upon the quantity of fluid which they contain, but upon its altitude*; or, in other words, *that any quantity of fluid, however small, may be made to balance any quantity or any weight, however great*. Let ACOQRPDB be a vessel filled with water, the bottom QR will sustain the same pressure as if it supported a quantity of water equal to MQRN. It is evident (59.) that the part EF is pressed with the column of fluid ABEF, and that the part DG equal to CD is pushed upwards with the weight of a column equal to ABCD. Now, as action and reaction are equal and contrary, the part DG reacts upon FH with a force equal to the weight of the column ABCD, and FH evidently sustains the smaller column DGFH; therefore FH sustains a pressure equal to the weight of the two columns ABCD and DGFH, that is, of the column BIHF. In the same way it may be shewn, that any other equal portion of the bottom QR sustains a

Fig. 6.



[1] This will be evident from the following proposition. *If every indefinitely small part of a surface be multiplied by its perpendicular distance from a given plane, the sum of the products will be equal to the product of the whole surface, multiplied by the perpendicular distance of its centre of gravity from the same plane.* In Fig. 7, let *a*, *c*, represent two weights suspended at their centre of gravity by the lines *a*A, *c*C, attached to the horizontal plane of which ABC is a section, and let *b* be the common centre of gravity of these weights, and *b*B the distance of this centre from the given plane, then $a \times aA + c \times cC = \overline{a+c} \times bB$.—Draw *an*, *cm*, at right angles to *b*B. Then since *b* is the common centre of gravity of the weights *a*, *c*, we shall have by the similar triangles *anb*, *cmb*, (Euclid, vi. 4.) $nb : mb = (ba : bc =) c : a$ (See Mechanics, Centre of Gravity). Hence $a \times nb = c \times mb$, or $a \times nB - bB = c \times bB - mB$, or $a \times nb - a \times bB = c \times bB - c \times mB$; then, by transposition, $a \times nb - c \times mB = a \times bB + c \times bB = \overline{a + C} + bB$. But $nB = aA$ and $mB = cC$, therefore, by substitution, $a \times aA + c \times cC = \overline{a+c} \times bB$. By supposing the two weights *a* and *c* united in their common centre of gravity, the same demonstration may be extended to any number of weights.

Fig. 7.

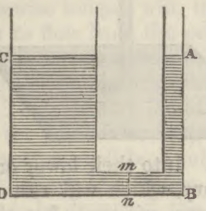


Pressure, &c. of Fluids.

similar pressure; and therefore it follows, that the pressure upon the bottom QR is as great as if it supported the whole column MNQR.

61. The same truth may be deduced from Prop. IV. For since the fluid in the two communicating vessels AB, CD, will rise to the same level, whatever be their size, the fluid in AB evidently balances the fluid in CD; and any surface *mn* is pressed with the same force in the direction B*m* by the small column AB, as it is pressed in the direction D*m* by the larger column CD.

Fig. 8.



Corollaries.

62. Cor. i. From this proposition it follows, that the whole pressure on the sides of a vessel which are perpendicular to its base, is equal to the weight of a rectangular prism of the fluid, whose altitude is that of the fluid, and whose base is a parallelogram, one side of which is equal to the altitude of the fluid, and the other to half the perimeter of the vessel.

Cor. ii. The pressure on the surface of a hemispherical vessel full of fluid, is equal to the product of its surface multiplied by its radius.

Cor. iii. In a cubical vessel the pressure against one side is equal to half the pressure against the bottom; and the pressure against the sides and bottom together, is to that against the bottom alone as three to one. Hence, as the pressure against the bottom is equal to the weight of the fluid in the vessel, the pressure against both the sides and bottom will be equal to three times that weight.

Cor. iv. The pressure sustained by different parts of the side of a vessel are as the squares of their depths below the surface; and if these depths are made the abscissæ of a parabola, its ordinates will indicate the corresponding pressures.

Definition.

Definition.

63. The *centre of pressure* is that point of a surface exposed to the pressure of a fluid, to which, if the total pressure were applied, the effect upon the plane would be the same as when the pressure was distributed over the whole surface: Or, it is that point to which, if a force equal to the total pressure were applied in a contrary direction, the one would exactly balance the other, or, in other words, the force applied and the total pressure would be *in equilibrio*.

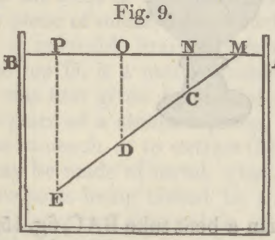
Prop. VIII.

64. The centre of pressure coincides with the centre of percussion.

To find the centre of pressure.

Let AB be a vessel full of water, and CE the section of a plane whose centre of pressure is required. Prolong CE till it cuts the surface of the water in M. Take any point D, and draw DO, EP, CN, perpendicular to the surface MP. Then if M be made the axis of suspension of the plane CE, the centre of percussion of the plane CE revolving round M will also be the centre of pressure. If MCE moves round M as a centre, and strikes any object, the percussive force of any point C is as its velocity, that is, as its distance CM from the centre of motion; therefore the percussive force of the points C, D, E, are as the lines CM, DM, EM. But the pressures upon the point C, D, E, are as the lines CN, DO, EP, and these lines are to one another as CM, DM, EM; therefore the percussive forces of the points C, D, E, are as the pressures upon these points. Consequently, the centre of pressure will always coincide with the centre of percussion.

Fig. 9.



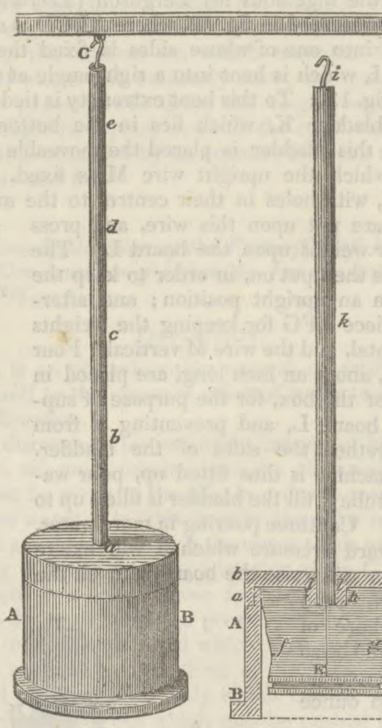
Pressure, &c. of Fluids.

Sect. II. *Instruments and Experiments for illustrating the Pressure of Fluids.*

Machine for illustrating the hydrostatic paradox. Fig. 10.

65. We have already shewn in Art. 57, that the pressure upon the bottoms of vessels filled with fluids does not depend upon the quantity of fluid which they contain, but upon its particular altitude. This proposition has been called the Hydrostatical Paradox, and is excellently illustrated by the following machine. In fig. 10, AB is a box which contains about a pound of water, and *abcd* a glass tube fixed to the end C of the beam of the balance, and the other end to a moveable bottom which supports the water in the box, the bottom and wire being of an equal weight with an empty scale hanging at the other end of the balance. If one pound weight be put into the empty scale, it will make the bottom rise a little, and the water will appear at the bottom of the tube *a*, consequently it will press with a force of one pound upon the bottom. If another pound be put into the scale, the water will rise to *b*, twice as high as the point *a*, above the bottom of the vessel. If a third, a fourth, and a fifth pound be put successively into the scale, the water will rise at each time to *c*, *d*, and *e*,

Fig. 10. Fig 11.



the divisions *ab*, *bc*, *cd*, *de*, being all equal. This will be the case, however small be the bore of the glass tube; and since, when the water is at *b*, *c*, *d*, *e*, the pressures upon the bottom are successively twice, thrice, four times, and five times as great as when the water was contained within the box, we are entitled to conclude that the pressure upon the bottom of the vessel depends altogether on the altitude of the water in the glass tube, and not upon the quantity it

Pressure, &c. of Fluids.

contains. If a long narrow tube full of water, therefore, be fixed in the top of a cask likewise full of water, then though the tube be so small as not to hold a pound of the fluid, the pressure of the water in the tube will be so great on the bottom of the cask, as to be in danger of bursting it; for the pressure is the same as if the cask was continued up in its full size to the height of the tube, and filled with water.

The smallest quantity of water may exert a force equal to any assignable one.

Upon this principle it has been affirmed that a certain quantity of water, however small, may be rendered capable of exerting a force equal to any assignable one, by increasing the height of the column, and diminishing the base on which it presses. This, however, has its limits; for when the tube becomes so small as to belong to the capillary kind, the attraction of the glass will support a considerable quantity of the water it contains, and therefore diminish the pressure upon its base.

Construction of the preceding machine.

Fig. 11.

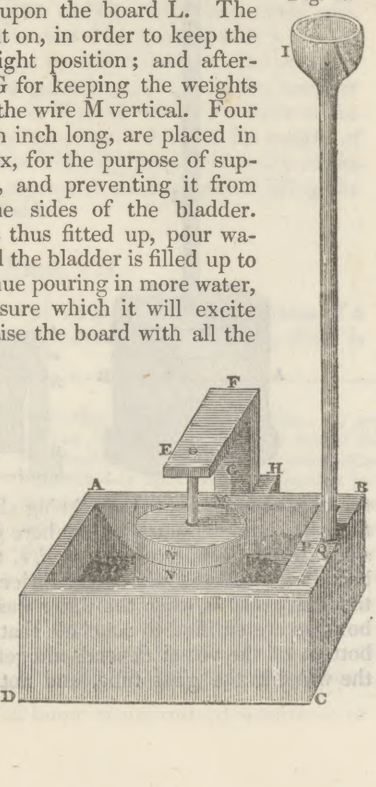
66. The preceding machine must be so constructed, that the moveable bottom may have no friction against the inside of the box, and that no water may get between it and the box. The method of effecting this will be manifest from fig. 11, where ABCD is a section of the box, and *abcd* its lid, which is made very light. The moveable bottom E, with a groove round its edges, is put into a bladder *fg*, which is tied close around it in the groove by a strong waxed thread. The upper part of the bladder is put over the top of the box at *a* and *d* all around, and is kept firm by the lid *abcd*, so that if water be poured into the box through the aperture *ll* in its lid, it will be contained in the space *f*E*gh*, and the bottom may be raised by pulling the wire *i* fixed to it at E.

The upward pressure of fluids illustrated by the hydrostatic bellows.

Fig. 12, 13.

67. The upward pressure of fluids is excellently illustrated by the hydrostatic bellows. The form given to this machine by the ingenious Mr Ferguson (*Lectures*, vol. ii. p. 111) is represented in fig. 12, where ABCD is an oblong square box, into one of whose sides is fixed the upright glass tube *a*I, which is bent into a right angle at the lower end as at *i*, fig. 13.: To this bent extremity is tied the neck of a large bladder K, which lies in the bottom of the box. Over this bladder is placed the moveable board L, fig. 14, in which the upright wire M is fixed. Leaden weights NN, with holes in their centre, to the amount of 16 pounds, are put upon this wire, and press with all their weight upon the board L. The cross bar P is then put on, in order to keep the glass tube in an upright position; and afterwards the piece EFG for keeping the weights N, N horizontal, and the wire M vertical. Four upright pins, about an inch long, are placed in the corners of the box, for the purpose of supporting the board L, and preventing it from pressing together the sides of the bladder. When the machine is thus fitted up, pour water into the tube I till the bladder is filled up to the board L. Continue pouring in more water, and the upward pressure which it will excite in the bladder will raise the board with all the weights NN, even though the bore of the tube should be so small as to contain no more than an ounce of water.

Fig. 12.



Experiment shewing tha the pressure of fluids arises from their gravity, and is propagated in every direction.

68. That the pressure of fluids arises from their gravity, and is propagated in every direction, may be proved by the following experiment. Insert into an empty vessel a number of

Fig. 13.

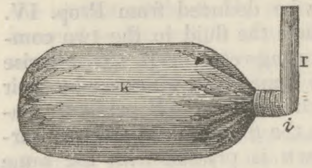
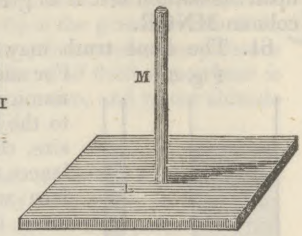


Fig. 14.



Pressure, &c. of Fluids.

glass tubes bent into various angles. Into their lower orifices introduce a quantity of mercury, which will rest in the longer legs on a level with these orifices. Let the vessel be afterwards filled with water; and it will be seen, while the vessel is filling, that the mercury is gradually pressed from the lower orifices towards the higher, where the water is prevented from entering. Now, in consequence of the various angles into which the glass tubes are bent, the lower orifices point to almost every direction; and therefore it follows, that the pressure of the superincumbent water is propagated in every direction. When a straight tube is employed to shew the upward pressure of fluids, the mercury which is introduced into its lower extremity must be kept in by the finger till the height of the water above the orifice is equal to fourteen times the length of the column of quicksilver: When the finger is removed the mercury will ascend in the tube.

Experiment shewing that the superior press upon the inferior strata of fluids.

69. The pressure of the superior strata of fluids upon the inferior strata may be shewn in the following manner. Immerse two tubes of different bores, but not of the capillary kind, in a vessel of mercury. The mereury will rise in the tube on a level with its surface in the vessel. Let water then be poured upon the mercury so as not to enter the upper orifices of the tubes, the pressure of the water upon the inferior fluid will cause the mercury to ascend in the tubes above the level of that in the vessel, but to the same height in both tubes. The columns of quicksilver in the two tubes are evidently supported by the pressure of the water on the inferior fluid. The same experiment may be made with oil and tinged water, the latter being made the inferior fluid.

Description of the common syphon.

70. The syphon is an instrument which shews the gravitation of fluids, and is frequently employed for decanting

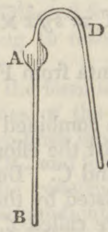
Fig. 15.

liquors. It is nothing more than a bent tube BAC, fig. 15, having one of its legs longer than the other. The shorter leg AC is immersed in the fluid contained in the vessel M; and if, by applying the mouth to the orifice B, the air be sucked out of the tube, the water in the vessel M will flow off till it be completely emptied. Now, it is obvious, that the atmosphere which has a tendency to raise the water in the shorter leg AC by its pressure on the surface ressure, &c. of Fluids.

of the water at M, has the same tondency to prevent the water from falling from the orifice B, by its pressure there, and therefore if the syphon had equal legs, no water could possibly issue from the orifice. But when the leg AB is longer than AC, the column of fluid which it contains being likewise longer, will, by its superior weight, cause the water to flow from the orifice B, and the velocity of the issuing fluid will increase as the difference between the two legs of the syphon is made greater.

The syphon is greatly improved by fixing a stop-cock D at the end of the longer branch, and placing on the same branch a small bent tube DE, communicating with the tube AB above D. When the aperture C is placed in the water to be drawn off, the mouth of the stop-cock D is closed, and the air is drawn out by suction at E from the longer branch. When there is no stop-cock at D, the finger may be applied there, till the air is sucked out at E.

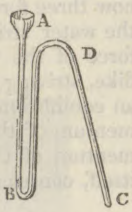
Fig. 16.



unten's phon.

An improved syphon by M. Bunten is shewn in fig. 16. where a bulb A is placed on the long branch AB. This syphon requires neither to be blown into nor sucked. When the long branch AB and bulb A are filled with fluid, and the other branch plunged in the fluid, the flow will be unremitting, as the bulb A in emptying itself draws off the liquid in contact with the short branch.

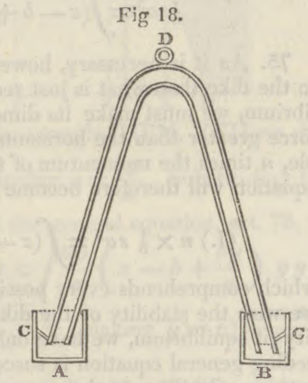
Fig. 17.



empel's proved phon.

Another improvement on the syphon is shewn in fig. 17. as made by M. Hempel of Berlin. The short branch has fitted into it a vertical tube BA, terminating in a funnel A. A part of the liquid to be drawn off is then poured into the funnel A, and as soon as the flow commences the long branch DC, the tube AB is withdrawn, and the flow continues.

Fig 18.



unter's taining yphon.

Another improvement on the syphon made by Mr Hunter of Thurston, is shewn in fig. 18. which has the peculiar advantage of retaining its charge. Two small cups or boxes A, B are fixed to the ends of the unequal branches by two screws C, C. When it is charged in the common way, and has been in use, it will stand vertically in the boxes A, B as a base, so that, when it is lifted by the ring D, it may be replaced, and will act as before. The same effect may be obtained by turning up the ends of the branches, and fixing to them a plate or piece of metal, upon which they may stand.

Ioveable ranch yphon.

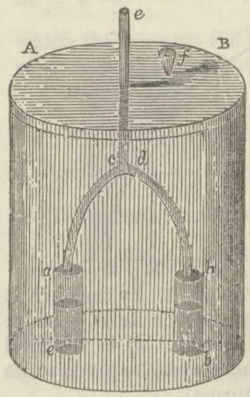
A moveable branch syphon, in which there is a joint at the top D, is a most valuable instrument, and the idea of it was first given by the late Mr Bryce, who employed it in place of a stomach-pump, in order to throw fluids into the stomach, or to extract them from it. The two branches may be made of metal, glass, or any other substance, the two parts being united by an air-tight joint. In cases of exigency two glass tubes, or pieces of any tube, might be joined into a syphon, by making the joint of a piece of bladder. One of the branches may be raised into any position for the purpose of charging it, and the instrument may be hung up charged, and ready for use, by a ring at the extremity of each branch.

71. In order to shew that the effect of the syphon depends upon the gravitation of fluids, M. Pascal devised the following experiment: In the large glass vessel AB, fasten by means of bees-wax two cylindrical cups a, b, containing tinged water, whose surface is about an inch higher in the one than in the other. Into the tinged water insert the legs of a glass syphon cd, having an open tube e fixed into the middle of it, and put a wooden cover on the vessel with a hole in its centre to receive the tube, and keep it in a vertical position. Then through the funnel f, fixed in another part of the cover, pour oil of turpentine into the larger vessel till it flow into the cups a, b, and rise above the arch of the syphon. The pressure of the oil upon the tinged water in the cups will cause the water to pass through the syphon from the higher cup to the lower, till the surfaces of the water in both the cups be reduced to a level. In order to explain this, suppose a horizontal plane eb to pass through the legs of the syphon, and the tinged water in the cups, the parts of this plane within the legs when the syphon is full, will be equally pressed by the columns of tinged water ce, db within the syphon; but the equal parts of this plane between the circumference of each leg of the syphon, and the circumference of each cylindrical cup, their diameters being equal, will sustain unequal pressures from their superincumbent columns, though the altitudes of these columns be equal. For since the pressure upon e is exerted by a column of oil ac, and a column of water ae, whereas the pressure upon b is exerted by a column of oil hd, and a column of water hb; the column ce, which contains the greatest quantity of water, will evidently exert the greatest force, and by its pressure will drive the tinged water from the cup a, through the syphon acd into the cup b, until a perfect equilibrium is obtained by an equality between the columns of water ae and hb.

Pressure, &c. of Fluids.

Experiment shewing that the effect of the syphon depends on the gravitation of fluids.

Fig. 19.



Sect. III.—*Application of the Principles of Hydrostatics to the Construction of Dikes, &c. for resisting the Pressure of Water.*

Definition.

Definition.

A dike is an obstacle either natural or artificial, which opposes itself to the constant effort of water to spread itself in every direction.

Different ways in which a dike may yield to the pressure of water.

72. In discussing this important branch of hydraulic architecture, we must inquire into the thickness and form which must be given to the dike in order to resist the pressure of the water. In this inquiry the dike may be considered as a solid body, which the water tends to overthrow, by turning it round upon its posterior angle C; or it may be regarded as a solid, whose foundation is immoveable, but which does not resist the pressure of the water through the whole of its height, and which may be separated into horizontal sections by the efforts of the fluid. A dike may considered also as a solid body which can be neither broken nor overturned, but which may be pushed horizontally from its base, and can preserve its stability only by the friction of its base on the ground which supports it. On these conditions are founded the calculations in the following proposition which contain the most useful information that theory can suggest upon the construction of dikes.

Prop. I.

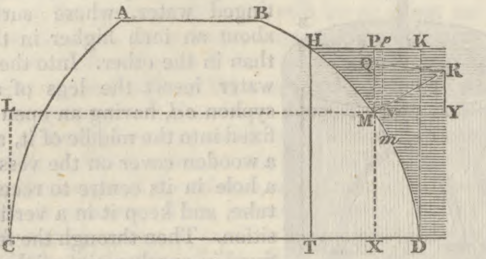
73. To find the dimensions of a dike which the water tends to overthrow by turning it round its posterior angle.

Pressure, &c. of Fluids.

To find the dimensions of a dike when water tends to turn it round its posterior angle.

Let ABCD, fig. 20, be the section of the dike, considered as a continuous solid, or a piece of firm masonry, HK the level

Fig. 20.



of the water which tends to overthrow it, by turning it round its posterior angle C, supposed to be fixed, and let AC, BD, be right lines or known curves. It is required to determine CD, the thickness which must be given to its base to prevent it from being overturned.

To the surface of the water HK draw the ordinates PM, pm infinitely near each other, and let fall from the points H and M the perpendiculars HT, MX. Draw the horizontal line ML and raise the perpendicular CL, and suppose

HP	$= x$
PM	$= y$
Pp or MV the fluxion of x	$= \dot{x}$
Vm the fluxion of y	$= \dot{y}$
HT	$= a$
DT	$= b$
CD	$= z$
The momentum of the area ABCD, or the force with which it resists being turned round the fulcrum C	$= Z$
The specific gravity of water	$= s$
The specific gravity of the dike	$= \sigma$

74. It is obvious, from art. 57, that every element sustains a perpendicular pressure proportional to the height PM. Let RM perpendicular to Mm represent the force exerted by the column of water MmpP, and let it be decomposed into two other forces, one of which RQ is horizontal, and has a tendency to turn the dike round the point C, and the other RY is vertical, and tends to press the dike upon its base. The force RQ is evidently $= s \times y \times \overline{\mathrm{M}m}$ (58.), and therefore the horizontal part of it will be only $sy \times \mathrm{M}m \times \frac{\mathrm{RQ}}{\mathrm{RM}}$. But the triangles RQM, MVm are evidently similar, consequently RQ:RM=Vm:Mm; hence $\frac{\mathrm{RQ}}{\mathrm{RM}} = \frac{\mathrm{V}m}{\mathrm{M}m} = \frac{\dot{y}}{\mathrm{M}m}$. Wherefore by substitution we have the force $\mathrm{RQ} = sy \times \mathrm{M}m \times \frac{\dot{y}}{\mathrm{M}m}$, and dividing by M$m$, we have $\mathrm{RQ} = sy\dot{y}$. The force RQ, therefore, will always be the same as the force against Vm, whatever be the nature of the curve BD. Now the momentum of this force with relation to the fulcrum C, or its power to make the dike revolve round C, is measured by the perpendicular CL, let fall from the centre of motion to the direction in which the force is exerted (see MECHANICS), consequently this momentum will be $sy\dot{y} \times \mathrm{CL} = sy\dot{y} \times \overline{a - y}$ (since $\mathrm{CL} = \mathrm{HT} - \mathrm{PM} = a - y$) $= say\dot{y} - syy\dot{y}$, whose fluent is $\frac{sayy}{2} - \frac{sy^3}{3}$, which by supposing $y = a$ becomes $\frac{1}{6} sa^3$ for the total momentum of the horizontal effort of the water to turn the dike round C. The vertical force RY or QM, which presses the dike upon its base. is evidently $sy \times \mathrm{M}m \times \frac{\mathrm{MQ}}{\mathrm{RM}}$, but on account of the similar triangles, $\frac{\mathrm{MQ}}{\mathrm{RM}} = \frac{\dot{x}}{\mathrm{M}m}$, consequently by substitution we shall have the force $\mathrm{RY} = sy \times \mathrm{M}m \times \frac{\dot{x}}{\mathrm{M}m} = sy\dot{x}$, after division by M$m$. The momentum, therefore, of the vertical force RY with relation to C, or its power to prevent the dike from moving round the fulcrum C, will be $sy\dot{x} \times \mathrm{CX}$; CX being the arm of the lever by which it acts, or the perpendicular let fall from the fulcrum upon the direction of the force. Now $\mathrm{CX} = \mathrm{CD} - \mathrm{DT} + \mathrm{TX}$ or HP, that is $\mathrm{CX} = \overline{z - b + x}$, therefore the momentum of the force $\mathrm{RY} = sy\dot{x} \times \overline{z - b + x}$, and the sum of the similar momenta from F to H will be the fluent $\int (\overline{z - b + x})\, sy\dot{x}$, the combined momentum of all the vertical forces which resist the efforts of the horizontal forces to turn the dike round C. But the efforts of the horizontal forces are also resisted by the weight of the dike, whose momentum we have called Z, therefore σZ, σ being the specific gravity of the dike, will be the momentum of the dike. We have now three forces acting at once, viz. the horizontal force of the water striving to overturn the dike, and the vertical force of the water combined with the momentum of the dike, striving to resist its overthrow, therefore we shall have an equilibrium between these three forces, when the momentum of the horizontal forces is made equal to the momentum of the vertical forces, added to that of the dike itself, consequently

$$\tfrac{1}{6} sa^3 = \int (z - b + x)\; sy\dot{x} + \sigma \mathrm{Z}.$$

75. As it is necessary, however, to give more stability to the dike than what is just requisite to preserve its equilibrium, we must make its dimensions such as to resist a force greater than the horizontal forces, a force, for example, n times the momentum of the horizontal forces.[1] The equation will therefore become

$$\text{(I.)}\quad n \times \tfrac{1}{6}\, sa^3 = \int (z - b + x)\, sy\dot{x} + \sigma \mathrm{Z},$$

which comprehends every possible case of stability; for if we wish the stability of the dike to have double the stability of equilibrium, we have only to make $n = 2$. The preceding general equation is susceptible of a variety of applications according to the nature of the curves which form the sides of the dike. It is at present worthy of remark, that since the momentum of the horizontal forces is always the same, whatever be the curvature of the sides AC, BD, and since the momentum of the vertical forces increases as the angle CDH diminishes, it follows that it will always be advantageous to diminish the angle CDH, and give as much slope as possible to the sides of the dike.

Equation containing the conditions of equilibrium on the supposition that the dike may slide upon its base.

76. Let us now consider the conditions that may be necessary to prevent the dike ABCD from sliding on its base CD. Since the base of the dike is supposed horizontal, the force which the dike opposes to the horizontal efforts of the water arises solely from the adhesion of the dike to its base, and from the resistance of friction. These two forces, there-

[1] The dimensions of the dike would be sufficiently strong to resist any additional force by neglecting the term σZ, which represents the vertical pressure of the water tending to keep the dike upon its base.

Pressure, &c. of Fluids.

fore, combined with the weight of the dike, form the force which resists the horizontal efforts of the water; an equilibrium will consequently obtain when the three first forces are made equal to the last. But the force of adhesion, and the resistance of friction, being unknown, may be made equal to the weight of the dike multiplied by the constant quantity m, which must be determined by experience. Now, calling A the area of the section ABCD, we shall have σA for its weight, and $m\sigma A$ for the resistance which is opposed to the horizontal efforts of the water. But we have already seen that the horizontal forces of the water upon M are equal to $sy\dot{y}$, whose fluent $\frac{1}{2}sa^2$ (when $a=y$) is the sum of all the horizontal forces; consequently, when an equilibrium takes place between these opposing forces, we shall have,

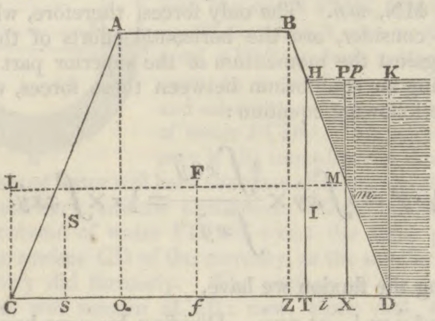
$$\text{(II.)}\ m\sigma A=\tfrac{1}{2}sa^2,\ \text{or}\ A=\frac{s}{\sigma}\times\frac{a^2}{2m}.$$

We might have added to the weight of the dike the vertical pressure of the water, but it has been neglected for the purpose of having the dike sufficiently strong to resist an additional force.

Form of the general equation when the sides of the dike are rectilineal.

77. We shall now proceed to inquire into the form which the general equation assumes when the sides of the dike are rectilineal. Let AC, BD, fig. 21. be two lines inclined to the horizon under given angles ACD, BDC, and let AB, CD be two horizontal lines. Retaining the construction and symbols in art. 73, let fall AQ, BZ, perpendicular to CD, and make $AQ=BZ=d$, $CQ=r$, and $DZ=r'$.

Fig. 21.



On account of the similar triangles HPM, FTH we shall have $a:b=y:x$, and therefore $x=\frac{by}{a}$. Substituting this value of x, instead of x in the general equation, art. 75, we have $\int(z-b+x)\ sy\dot{x}=\int\frac{sb}{a}\left(z-b+\frac{by}{a}\right)\ y\dot{y}=\frac{sbzyy}{2a}-\frac{sbbyy}{2a}+\frac{sbby^3}{3a^2}=(\text{making } y=a)\ \frac{sbza}{2}-\frac{sb^2a}{6}$; now the momentum of the dike ABCD with relation to C, is equal to the whole area of the dike ABCD collected in its centre of gravity, and placed at the end of a lever whose length is the horizontal distance of that centre of gravity from the fulcrum C. But the area of $ABQZ=QZ\times ZB=\overline{z-r'-r}\times d$; the area of the triangle $ACQ=\frac{CQ\times QA}{2}=\frac{dr}{2}$, and the area of the triangle $BZD=\frac{DZ\times ZB}{2}=\frac{dr'}{2}$. Now the lever by which the area ABQZ, collected in its centre of gravity F. acts upon the fulcrum, is evidently $=Cf=CQ+Qf=CQ+\frac{1}{2}QZ=r+\frac{\overline{z-r'-r}}{2}$, consequently the momentum by which the area ABCD resists the horizontal forces that conspire to give it a motion of rotation about C will be $=\overline{z-r'-r}\times d\times r+\frac{\overline{z-r'-r}}{2}$. The lever by which the triangle BZD acts, when collected in its centre of gravity I, is evidently Ci; but by the property of the centre of gravity $Di=\frac{2}{3}DZ=\frac{2r'}{3}$, hence $Ci=CD-Di=z-\frac{2r'}{3}$, consequently the energy of the triangle BZD to resist the efforts of the water acting horizontally will be $=\frac{dr'}{2}\times\overline{z-\frac{2r'}{3}}$. The lever of the triangle ACQ is plainly $Cs=\frac{2}{3}CQ=\frac{2r}{3}$, consequently the momentum of ACQ, collected in its centre of gravity S, will be $=\frac{dr}{2}\times\frac{2r}{3}$. Having thus found the momentum of the rectangle ABQZ, and of the triangles BZD, ACQ, the sum of these momenta will be the momentum Z, with which the dike opposes the horizontal efforts of the water, therefore we shall have

$$Z=\overline{z-r'-r}\times d\times r+\frac{\overline{z-r'-r}}{2}+\frac{dr'}{2}\times\overline{z-\frac{2r'}{3}}+\frac{dr}{2}\times\frac{2r}{3};$$

and by multiplication,

$$Z=\frac{dzz}{2}-\frac{dr'z}{2}+\frac{dr'r'}{6}-\frac{drr}{6}.$$

By substituting this value of Z in the general equation in art. 75, we shall have

Resulting equation when both its sides are rectilineal and inclined.

$$\text{(III.)}\ n\times\tfrac{1}{6}sa^3=\frac{sbza}{2}-\frac{sbba}{6}+\frac{\sigma dzz}{2}-\frac{\sigma dr'z}{2}+\frac{\sigma dr'r'}{6}-\frac{\sigma drr}{6}.$$

a quadratic equation, which will determine in general the base z of a dike, when its sides are rectilineal and inclined at any angle to the horizon.

78. When the angle ACQ is a right angle, or when the posterior side AC of the dike is perpendicular to the horizon, the quantity r becomes $=0$, and the last term of the preceding equation in which r appears will vanish, consequently the equation will now become

Resulting equation when the posterior side of the dike is vertical.

$$\text{(IV.)}\ n\times\tfrac{1}{6}sa^3=\frac{sbza}{2}-\frac{sbba}{6}+\frac{\sigma dzz}{2}-\frac{\sigma dr'z}{2}+\frac{\sigma dr'r'}{6}.$$

Resulting equation when both sides of the dike are vertical.

79. When the angles ACQ and BDZ are both right, the dike becomes rectangular, with its sides perpendicular to its base. In this case both r and r' become each $=0$, and therefore all the terms in which they are found will vanish. In this case too $DT=b$ becomes $=0$, and therefore the terms in which it appears will likewise vanish. The general equation will now become

$$\text{(V.)}\ n\times\tfrac{1}{6}sa^3=\frac{\sigma dzz}{2}\ \text{a pure quadratic.}$$

Application of the formulæ.

80. In order to shew the application of the preceding formulæ, and at the same time the advantage of inclining the sides of the dike, let us suppose the depth of the water, and also the height of the dike, to be 18 feet, so that B will coincide with H. Let us also suppose, what is generally the case in practice, that the declivity of the sides is $\frac{1}{6}$ of

Pressure, &c. of Fluids.

their altitude, that is $DZ = CQ = \frac{1}{6} BZ$. Let the specific gravity of the dike be to that of water as 12 to 7; and suppose it is wished to make the stability of the dike twice as great as the stability of equilibrium, that is, to make it capable of resisting a force twice as great as that which it really sustains. Then, upon these conditions, we shall have $BZ = HT$, or $a = d = 18$ feet; $CQ = DZ = DT$, or $r' = r = b = 3$ feet; $s = 7$; $\sigma = 12$; and $n = 2$. By substituting these numerical values in the general equation No. III, it becomes

$$zz - \frac{45}{36} z = \frac{4599}{39} \text{ feet};$$

a quadratic equation, which, after reduction, will give $z = 12$ feet nearly. When $z = 12$, the area of the dike ABCD will be 162 square feet.

Advantages of inclining the sides of the dike.

81. Let us now suppose the sides of the dike to be vertical, the equation No. V. will give us $z = 11$ feet 2 inches, which makes the area of the dike more than 201 square feet. The area of the dike with inclined sides is therefore to its area with vertical sides nearly as 4 to 5: and hence we may conclude that a dike with inclined sides has the same stability as a dike with vertical sides, while it requires $\frac{1}{5}$ less materials.

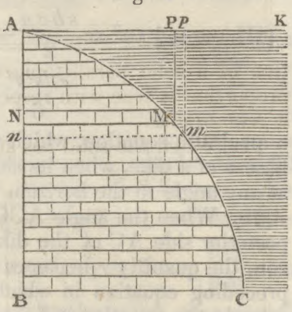
Prop. II.

82. To find the dimensions of a dike which can neither slide upon its base, nor turn round its posterior angle; but which is composed of horizontal sections, which may be separated from each other.

To find the dimensions of the dike when water tends to separate it into horizontal sections.

In solving this proposition, we must find the curvature of the side exposed to the pressure of the water, which will make all the different sections or horizontal laminæ equally capable of resisting the different forces which tend to separate them. If the lamina NM does not resist the column PM, which partly presses it in the direction MN as powerfully as the lamina nm resists the horizontal pressure of the column pm, the lamina NM is in danger of being separated from the lamina nm. But if all the laminæ NM, nm resist with equal force the horizontal efforts of the water, and if the dike cannot be made to slide upon its base nor turn round its posterior angle T, it cannot possibly yield to the pressure of the water; for it is impossible to separate one lamina from another, unless the one opposes a less resistance than the other. To simplify the investigation as much as possible, let us suppose the posterior side of the dike to be vertical, and the depth of the water to be equal to the height of the dike.

Fig. 22.



83. Let ABC be the section of the dike, AK the surface of the water, AC the curvature required, AB its posterior side; MN nm a horizontal lamina infinitely small, in the direction of which the dike has a tendency to break, in consequence of the efforts of the water upon AM.

If the dike should break in the direction MN, the superior part AMN will detach itself from the inferior part MNBC, by moving from M towards N; and at the moment when the impulse takes place, it will have a small motion of rotation round the point N. We must therefore determine the forces which act upon the lamina MNnm, and form an equation expressing their equilibrium round the point N. The forces alluded to are evidently, 1. The horizontal efforts of the water; 2. The vertical efforts of the water; 3. The weight of the part AMN; and, 4. The adhesion of the two surfaces MN, mn. Of these four forces, the first is the only one which has a tendency to overthrow the portion AMN of the dike; and its efforts are resisted by the three other forces. In order to find the momenta of these forces with regard to the point N, let us suppose

Enumeration of the forces which act upon the dike.

$$\begin{array}{ll} AP = NM & = x \\ PM & = y \\ \text{The specific gravity of water} & = s \\ \text{The specific gravity of the dike} & = \sigma \end{array}$$

Then we shall have,

Momentum of these forces.

1. The momentum of the horizontal forces of the water will be $= \frac{1}{6} sy^3$, by the same reasoning that was employed in art. 74.

2. The momentum of the part AMN of the dike will be $= \sigma \int x\dot{y}$ the area of the surface AMN, multiplied by the distance of its centre of gravity from the fulcrum N, which is equal to $\dfrac{\frac{1}{2}\int xx\dot{y}}{\int x\dot{y}}$. See Mechanics.

84. In order to simplify the calculus, and at the same time increase the stability of the dike, we shall neglect the vertical force of the water, and the adhesion of the two surfaces MN, mn. The only forces, therefore, which we have to consider, are the horizontal efforts of the water acting against the momentum of the superior part AMN. By making an equilibrium between these forces, we shall have the following equation:

$$\tfrac{1}{2} sy^3 = \sigma \int x\dot{y} \times \frac{\frac{1}{2}\int xx\dot{y}}{\int x\dot{y}} = \tfrac{1}{2}\sigma \times \int xx\dot{y}.$$

By taking the fluxion we have,

$\frac{1}{2} sy^2 \dot{y} = \frac{1}{2} \sigma \times xx\dot{y}$. Dividing by $\dot{y}$ we have

$\frac{1}{2} sy^2 = \frac{1}{2} \sigma \times x^2$, which by reduction becomes

$$y = \sqrt{\frac{\sigma}{s}} \times x.$$

The line AMC therefore is rectilineal, and the base BC is to the altitude BA as $\sqrt{s} : \sqrt{\sigma}$; that is, as the square root of the specific gravity of the water is to the square root of the specific gravity of the dike.

Equation containing the conditions of equilibrium on the supposition that the dike may slide upon its base.

85. In order to prevent the superior portion AMN from sliding on its base MN, we must procure an equilibrium between the adhesion of the surfaces MN, mn and the horizontal force exerted by the water. Now, the sum of all the horizontal forces exerted by the water is (by art. 76.) $\frac{1}{2} sy^2$, and the adhesion may be represented by some multiple m, of its weight, the constant quantity m being determined by experience. The adhesion will therefore be $m \times \sigma \int x\dot{y}$, and the equation of equilibrium will be

$\frac{1}{2} sy^2 = m \times \sigma \int x\dot{y}$, the fluxion of which is

$sy\dot{y} = m \times \sigma x\dot{y}$. Dividing by $\dot{y}$ we have

$sy = m\sigma x$, and therefore

$x : y = s : m\sigma$.

Hence the base BC of the dike is to its altitude BA as the specific gravity of water is to a multiple m of the specific

Of Specific Gravities.

gravity of the dike, m being a constant quantity which experiments alone can determine.

In a work by the Abbé Bossut and M. Viallet, entitled *Recherches sur la Construction la plus avantageuse des Digues*, the reader will find a general solution of the preceding problem, in which the vertical efforts of the water and the adhesion of the surfaces are considered. This able work, which we have followed in the preceding investigation, contains much practical information on the construction of dikes of every kind; and may be considered as a continuation of the second part of Belidor's *Architecture Hydraulique*.

CHAPTER II.—OF SPECIFIC GRAVITIES.

Definition.

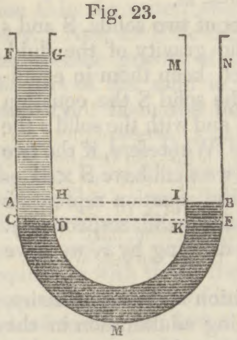
Specific gravity defined.

86. The absolute weights of different bodies of the same bulk are called their *specific gravities* or *densities;* and one body is said to be *specifically heavier* or *specifically lighter* than another, when under the same bulk it contains a greater or less quantity of matter. Brass, for example, is said to have eight times the specific gravity of water, because one cubic inch of brass contains eight times the quantity of matter, or is eight times heavier than a cubic inch of water.

Prop. I.

87. Fluids pressing against each other in two or more communicating vessels, will be in equilibrio when the perpendicular altitudes above the level of their junction are in the inverse ratio of their specific gravities.

Fig. 23.



If a quantity of mercury be poured into the vessel FMN, it will be in equilibrio when it rises to the same level AHIB, in both tubes. Take away an inch of mercury ACDH, and substitute in its room $13\frac{1}{2}$ inches of water FCDG. Then since mercury is $13\frac{1}{2}$ times heavier than water, $13\frac{1}{2}$ inches of water will have the same absolute weight as one inch of mercury, and the equilibrium will not be disturbed; for the column of water FD will exert the same pressure upon the surface CD of the mercury, as the smaller column of mercury did formerly. The surface of the mercury, therefore, will remain at IB: now, since AB, CE, are horizontal lines, AC will be equal to IK; but FC was made $13\frac{1}{2}$ times AC, therefore $FC = 13\frac{1}{2}$ times IK, that is $FC : IK = 13\frac{1}{2} : 1$, the ratio between the specific gravities of mercury and water.

Construction of the barometer.

88. On this proposition depends the theory of the barometer. Let a quantity of mercury be introduced into the tube FMN, and let the pressure of the atmosphere be removed from the surface IB; the pressure of the air upon the other surface CD will be the same as if the tube FD were continued to the top of the atmosphere, and therefore, instead of the column of water FD we have a column of air equal to the height of the atmosphere acting against the mercury CDMIB; the mercury consequently will rise towards N, so that its height will be to the height of the atmosphere as the specific gravity of air is to the specific gravity of mercury; but as the density of the air diminishes as it recedes from the earth, we must take the specific gravity of the air at a mean height in the atmosphere. It is obvious from the proposition, that the altitude of the column of mercury which balances the column of air, must be reckoned from CD, the level of their junction; and that, when the specific gravity of the air is diminished, the mercury will fall, and will again rise when it regains its former density.

Prop. II.

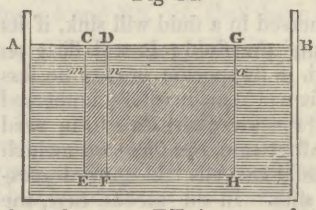
Bodies immersed in a fluid are pressed upwards with a force equal to the weight of the quantity of fluid displaced.

89. If any body is immersed in a fluid, or floats on its surface, it is pressed upwards with a force equal to the weight of the quantity of fluid displaced.

Demonstration when a parallelopiped is immersed in the fluid.

Let mH be the section of a body immersed in the vessel AB filled with a fluid. Any portion mn of its upper surface is pressed downwards by the column of fluid CmnD (59.); but the similar portion EF of its lower surface is pressed upwards with a column of fluid equal to CEFD, therefore the part EF is pressed upwards with the difference of these forces, that is, with a force equivalent to the column of fluid mEFn, for CEFD — CmnD = mEFn. In the same way it may be shewn, that the remaining part FH is pressed upwards with a force equal to the weight of a column nFHo; and therefore it follows, that the rectangle mEHo is pressed upwards with a force equivalent to a column mEHo, that is, to the quantity of fluid displaced.

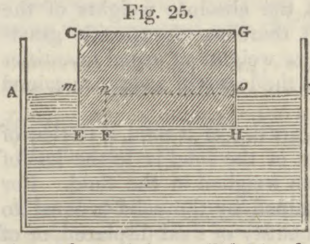
Fig. 24.



When the parallelopiped floats in the fluid.

90. If the body floats in the fluid, like CH in the vessel AB, the same consequence will follow; for the body CH is evidently pressed upwards with a force equivalent to the column mEHo, that is, to the part immersed or the quantity of fluid displaced. Now, as the same may be demonstrated of every other section of a solid parallelopiped, we may conclude, that the proportion is true with respect to every solid whose section is rectangular.

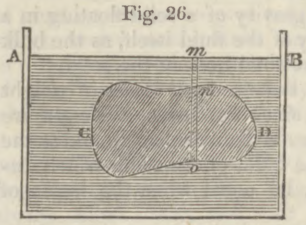
Fig. 25.



When the solid has any other form.

91. When the solid has any other form, as CD, however irregular, we may conceive its section to be divided into a number of very small rectangles $n\,o$: then (57.) the small portion of the solid at n is pressed downwards by a column of particles $m\,n$, and the small portion at o is pressed upwards by a column of particles equal to $n\,o$; therefore the difference of these forces, viz. the column $n\,o$, is the force with which the portion o is pressed upwards. In the same manner it can be shewn, that every other similar portion of the lower surface of the solid CD is pressed upwards with a force equal to a column of particles whose height is equal to the vertical breadth of the solid; but all these columns of particles must occupy the same space as the solid itself, therefore any solid body immersed in a fluid, or floating on its surface, is pressed upwards with a force equal to the weight of the quantity of fluid displaced.

Fig. 26.



The weight of a floating body is equal to the weight of the quantity of fluid displaced.

92. Cor. 1. When a body floats in a fluid, the weight of the quantity of fluid displaced is equal to the weight of the floating solid. For since the solid is in equilibrium with the fluid, the force which causes it to descend must be equal to the force which presses it upwards; but the force which keeps a part of the solid immerged in the fluid is the weight of the solid, and the force which presses the solid upwards, and prevents it from sinking, is equivalent to the weight of the quantity of fluid displaced (89.); there-

Of Specific Gravities.

fore these forces, and the weights to which they are equivalent, must be equal.

93. Cor. 2. A solid weighed in a fluid loses as much of its weight as is equal to the weight of the quantity of fluid displaced; for since the body is pressed upwards with a force equal to the weight of the fluid displaced (89.), this pressure acts in direct opposition to the natural gravity or absolute weight of the solid, and therefore diminishes its absolute weight by a quantity equal to the weight of the fluid displaced. The part of the weight thus lost is not destroyed: It is only sustained by a force acting in a contrary direction.

94. Cor. 3. A solid immersed in a fluid will sink, if its specific gravity exceed that of the fluid: It will float on the surface, partly immersed, if its specific gravity be less than that of the fluid; and it will remain wholly immersed wherever it is placed, if the specific gravities of the solid and fluid are equal. In the first case, the force with which the solid is pressed downwardly exceeds the upward pressure, and therefore it must sink. In the second case, the upward pressure exceeds the pressure downwards, and therefore the body must float; and, in the third case, the upward and downward pressures being equal, the solid will remain wherever it is placed.

95. Cor. 4. The specific gravities of two or more fluids are to one another as the losses of weight sustained by the same solid body, and specifically heavier than the fluids, when weighed in each fluid respectively. The solid in this case displaces equal quantities of each fluid; but the losses of weight are respectively as the absolute weights of the quantities displaced (Cor. 2.), therefore the specific gravities, which are as the absolute weights of equal quantities of any body (86.), must be as the losses of weight sustained by the immersed solid.

96. Cor. 5. The specific gravity of a solid is to that of a fluid as the absolute weight of the solid is to the loss of weight which it sustains when weighed in the fluid. For since the loss of weight sustained by the solid is equal to the absolute weight of the quantity of fluid displaced, or of a quantity of fluid of the same bulk as the solid, the specific gravities, which (86.) are in the ratio of the absolute weights of equal volumes, must be as the absolute weight of the solid to the loss of weight which it sustains.

97. Cor. 6. The specific gravity of a solid floating in a fluid, is to the specific gravity of the fluid itself, as the bulk of the part immersed is to the total bulk of the solid.

98. Cor. 7. Bodies which sustain equal losses of weight are of the same bulk. For, since the losses of weight are as the weights of the quantities of fluid displaced, and as the quantities displaced are as the bulks of the solids which displace them, the bulks must be equal when the losses of weight are equal.

The preceding corollaries deduced from an equation of equilibrium.

99. The preceding corollaries may be expressed algebraically, and may be deduced from a general equation in the following manner. Let B be the total bulk of a floating body, and C the part of it which is immersed; let S be the specific gravity of the solid, and s that of the fluid. Then it is obvious, that the absolute weight of the solid will be expressed by $B \times S$, and the absolute weight of the fluid displaced by $C \times s$; for the fluid displaced has the same bulk as the part of the solid which is immersed. In order that an equilibrium may obtain between the solid and fluid, we must have $B \times S = C \times s$: Now, when $s > S$, we have $B > C$, so that the solid will float, which is the second case of Cor. 3.—When $S = s$ we have $B = C$, which is the third case of Cor. 3.—When $S > s$ we have $C > B$, that is, the body will sink below the surface; and it will descend to the bottom, for it cannot be suspended in the fluid without some power to support it; and if such a power were necessary, we should have $B \times S > C \times s$, which is contrary to the equation of equilibrium.

100. From the equation $B \times S = C \times s$ we have (Euclid VI. 16.) $S : s = B : C$, which is Cor. 6.—When the body is completely immersed we have $B = C$, in which case the equation becomes $B \times S = B \times s$; and when the solid is specifically heavier than the fluid, it will require a counterweight to keep the solid suspended in the fluid. Let W be the counterweight necessary for keeping the solid suspended in the fluid, then in the case of an equilibrium the equation will be $B \times s + W = B \times S$, or $B \times S - W = B \times s$, or $S \times \overline{B \times S - W} = S \times B \times s$, whence (Euclid VI. 16.) $S : s = B \times S : B \times S - W$, which is Cor. 5.

101. If the same solid body is plunged in a second fluid of a different specific gravity from the first, let σ be the specific gravity of the second fluid, and w the counterweight necessary to keep the solid suspended in it.—The equation for the first fluid was $B \times s + W = B \times S$ (100.), and the equation for the second fluid will be $B \times \sigma + w = B \times S$; therefore we shall have, by the first equation, $S \times B - W = s \times B$, and by the second $S \times B - w = \sigma \times B$, and consequently $s \times B : \sigma \times B = S \times B - W : S \times B - w$, or (Euclid V. 16.) $s : \sigma = S \times B - W : S \times B - w$, which is Cor. 4.; for the losses of weight in each fluid are evidently represented by $\overline{S \times B} - W$ and $\overline{S \times B} - w$.

102. If B and b express the bulks of two solids, S and s their specific gravities, σ the specific gravity of the fluid, and W, w the counterweights which keep them in equilibrium with the fluid. Then with the solid S the equation will be $S \times B - W = \sigma \times B$ (101.); and with the solid s the equation will be $s \times b - w = \sigma \times b$. Wherefore, if the two solids sustain equal losses of weight, we shall have $S \times B - W = s \times b - w$, since each side of the equation represents the loss of weight sustained by each solid respectively. Consequently, $\sigma \times B = \sigma \times b$, and dividing by σ, we have $B = b$, which is Corollary 7.

Method of detecting adulteration in metals.

103. From the preceding proposition and its corollaries, we may deduce a method of detecting adulteration in the precious metals, and of resolving the problem proposed to Archimedes, by Hiero, king of Syracuse. Take a real guinea, and a counterfeit one made of copper and gold. If the latter be lighter than the former, when weighed in a pair of scales, the imposition is instantly detected; but should their weight be the same, let the two coins be weighed in water, and let the loss of weight sustained by each be carefully observed, it will then be found that the counterfeit will lose more of its weight than the unadulterated coin. For, since the specific gravity of copper exceeds that of gold, and since the absolute weights of the coins were equal, the counterfeit guinea must be greater in bulk than the real one, and will therefore displace a greater quantity of water, that is (93.), it will lose a greater part of its weight.

Problem proposed by Hiero to Archimedes.

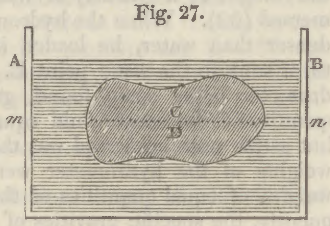
104. Hiero, king of Syracuse, having employed a goldsmith to make him a crown of gold, suspected that the metal had been adulterated, and inquired at Archimedes if his suspicions could be verified or disproved without injuring the crown. The particular method by which Archimedes detected the fraud of the goldsmith is not certainly known; but it is probable that he did it in the following manner. A quantity of gold, of the same absolute weight as the crown, would evidently have the same bulk also, if the crown were pure gold, and would have a greater bulk if the crown were made of adulterated gold. By weighing, therefore, the quantity of gold and the crown in water, and observing their respective losses of weight, Archimedes found that the crown lost more of its weight than the quantity of gold; and therefore concluded, that as the crown must have displaced a greater portion of water than the piece of gold, its bulk must likewise have been greater, and the metal adulterated of which it was composed.

Specific Gravities.

Prop. III.

105. If two immiscible fluids, of different specific gravities, and a solid of an intermediate specific gravity, be put into a vessel, the part of the solid in the lighter fluid will be to the whole solid, as the difference between the specific gravities of the solid and the heavier fluid, is to the difference between the specific gravities of the two fluids.

Fig. 27.



Let AB (fig. 27.) be the vessel which contains the two fluids, suppose mercury and water, and the solid CD. The mercury being heavier than water, will sink to the bottom, and have mn for its surface, and the water will occupy the space AB mn. The solid having a greater specific gravity than water, will sink in the water (94.); but having a less specific gravity than mercury, it will float in the mercury. It will therefore be suspended in the fluids, having one portion C in the water, and the other portion D in the mercury. Now let S be the specific gravity of the mercury, s the specific gravity of the water, σ that of the solid, C the part of the solid in the water, and D the part in the mercury. Then the bulk of the solid is $C+D$, and its weight $\sigma \times \overline{C+D}$: The quantity of water displaced by the part C, or the loss of weight sustained by the part C, will be $C \times s$; and the quantity of mercury displaced, or the loss of weight sustained by part D, will be $D \times S$. But as the solid is suspended in the fluids, and therefore in equilibrio with them, the whole of its weight is lost. Consequently, the part of its weight which is lost in the water, added to the part lost in the mercury, must be equal to its whole weight; that is, $\overline{C \times s} + \overline{D \times S} = \sigma \times \overline{C+D}$, or $s\,C + SD = \sigma\,C + \sigma\,D$. Transposing $\sigma\,C$ and SD, we have $s\,C - \sigma\,C = SD - \sigma\,D$, or $C \times \overline{s - \sigma} = D \times \overline{S - \sigma}$, and (Euclid VI. 16.) $C : D = \overline{s - \sigma} : \overline{S - \sigma}$. Then, by inversion and composition (Euclid V. Propositions B and 18.) $C : \overline{C+D} = \overline{S - \sigma} : \overline{S - s}$. Q. E. D.

106. Cor. 1. From the analogy $C : D = \overline{s - \sigma} : \overline{S - \sigma}$, we learn that the part of the solid in the heavier fluid, is to the part in the lighter fluid, as the difference between the specific gravities of the solid and the lighter fluid, is to the difference between the specific gravities of the solid and the heavier fluid.

107. Cor. 2. When s is very small compared with S, we may use the analogy $C : C+D = \sigma : s$, though in cases where great accuracy is necessary this ought not to be done. When the specific gravity of a body, lighter than water, is determined by comparing the part immersed with the whole body, there is evidently a small error in the result; for the body is suspended partly in water and partly in air. It is, in fact, a solid of an intermediate specific gravity floating in two immisceable fluids, and therefore its specific gravity should be ascertained by the present proposition.

Prop. IV.

108. If two bodies, whether solid or fluid, be mixed together so as to form a compound substance, the bulk of the heavier is to the bulk of the lighter ingredient, as the difference between the specific gravities of the compound, and the lighter ingredient, is to the difference between the specific gravities of the compound and the heavier ingredient.

Of Specific Gravities.

To find the bulk of the ingredients, their specific gravities and that of the compound being given.

Let S and s be the specific gravities of the two ingredients, σ the specific gravity of the compound, and B, b the bulks of the ingredients; then the bulk of the compound will be $B+b$, and its weight $\sigma \times \overline{B+b}$. The weight of the ingredient B will be $B \times S$, and that of the other ingredient $b \times s$; and as the weight of the compound must be equal to the weight of its ingredients, we have the following equation $\sigma\,b + \sigma\,B = BS + b\,s$, and by transposing $\sigma\,b$ and BS, we shall have $B\,\sigma - BS = b\,s - b\,\sigma$, or $B \times \overline{\sigma - S} = b \times \overline{s - \sigma}$; therefore (Euclid VI. 16.) $B : b = \overline{s - \sigma} : \overline{\sigma - S}$. Q. E. D.

A compound mass, whether solid or fluid, is sometimes greater in bulk than the sum of the bulks of its ingredients.

109. In the preceding proposition, it has been taken for granted that the magnitude of the compound is exactly equal to the sum of the magnitudes of the two ingredients. This, however, does not obtain universally either in fluids or solids; for an increase or diminution of bulk often attends the combination of two different ingredients. A cubical inch of alcohol, for example, combined with a cubical inch of water, will form a compound which will measure less than two cubical inches; and a cubical inch of tin, when incorporated in a fluid state with a cubical inch of lead, will form a compound, whose bulk will exceed two cubical inches. The preceding proposition, however, is, even in these cases, of great use in ascertaining the increase or decrease of bulk sustained by the compound, by comparing the computed with the observed bulk.

Prop. V. Problem.

110. How to determine the specific gravities of bodies, whether solid or fluid.

To determine the specific gravities of solids and fluids.

The simplest and most natural way of finding the specific gravities of bodies would be to take the absolute weights of a cubic inch, or any other determinate quantity, of each substance; and the number thus found would be their specific gravities. But as it is difficult to form two bodies of the very same size, and often impossible, as in the case of precious stones, to give a determinate form to the substance under examination, we are obliged to weigh them in a fluid, and deduce their specific gravities from the losses of weight which they severally sustain. Water is a fluid which is always employed for this purpose, not only because it can be had without difficulty, but because it can be procured of the same temperature, and of the same density, in every part of the world. The specific gravity of water is always called 1.000, and with this, as a standard, the specific gravity of every other substance is compared. Thus, if a certain quantity of water weighed four pounds, and a similar quantity of mercury 54 pounds, the specific gravity of the mercury would be called $13\frac{1}{2}$, because as $4 : 54 = 1 : 13\frac{1}{2}$. In order, therefore, to determine the densities of bodies, we have occasion for no other instrument than a common balance with a hook fixed beneath one of its scales. When fitted up in this way, it has been called the *hydrostatic balance*, which has already been described under the article Balance, *Hydrostatical*.

Hydrostatic balance.

To find the specific gravity of a solid heavier than water.

111. *When the substance is heavier than its bulk of water.*—Suspend the solid by means of a fine silver wire to the hook beneath the scale, and find its weight in air. Fill a jar with pure distilled water, of the temperature of 62° of Fahrenheit's thermometer, and find the weight of the solid when immersed in this fluid. The difference of these weights is the loss of weight sustained by the solid. Then (96.), as the loss of weight is to the weight of the solid in air, so is 1.000 the specific gravity of water to a

Of Specific Gravities.

fourth proportional, which will be the specific gravity of the solid. But as the third term of the preceding analogy is always 1.000, the fourth proportional, or density of the solid, will always be had by dividing the weight of the solid in air by its loss of weight in water. If the solid substance consists of grains of platina or metallic filings, place it in a small glass bucket. Find the weight of the bucket in air, when empty, and also its weight when it contains the substance. The difference of these weights will be the weight of the substance in air. Do the very same in water, and its weight in water will be had. Its specific gravity will then be found as formerly. If the body is soluble in water, or so porous as to absorb it, it should be covered with varnish or some unctuous substance. When it is weighed in water, it should never touch the sides of the glass jar, and it must be carefully freed from any bubbles of air that happen to adhere to it.

To find the specific gravity of a solid lighter than water.

112. *When the substance is lighter than its bulk of water.*—Fasten to it another solid heavier than water, so that they may sink together. Find the weight of the denser body, and also of the compound body, both in air and in water; and by subtracting their weight in water from their weight in air, find how much weight they have severally lost. Then say as the difference between their losses of weight is to the weight of the light body in air, so is 1.000 to the specific gravity of the body.

To find the specific gravity of powders.

113. *When the substance is a powder which absorbs water, or is soluble in it.*—Place a glass phial in one scale, and counterpoise it by weights in the other. Fill this phial with the powder to be examined; and having rammed it as close as possible to the very top, find the weight of the powder. Remove the powder from the phial, and fill it with distilled water, and find its weight. The weight of the powder, divided by the weight of the water, will be the specific gravity of the former. See art. 124.

To find the specific gravity of fluids.

114. *When the substance is a fluid*, its specific gravity may be determined very accurately by the method in the preceding article, or by the following method, deduced from article 95.—Take any solid specifically heavier than water, and the given fluid. Find the loss of weight which it sustains in water, and also in the given fluid. Then, since the specific gravities are as the losses of weight sustained by the same solid, the specific gravity of the fluid required will be found by dividing the loss of weight sustained by the solid in the given fluid, by the loss of weight which it sustains in water.

SECT. II. *On the Hydrometer.*

Hydrometer invented by Hypatia.

115. In order to determine, with expedition, the strength of spirituous liquors, which are inversely proportional to their specific gravities, an instrument more simple, though less accurate, than the hydrostatic balance, has been generally employed. This instrument is called a *hydrometer*, sometimes an *areometer* and *gravimeter*, and very erroneously a *hygrometer* by some foreign authors. It seems to have been invented by Hypatia, the daughter of Theon Alexandrinus, who flourished about the end of the fourth century; though there is some foundation for the opinion that the invention is due to Archimedes.

Fahrenheit's hydrometer.

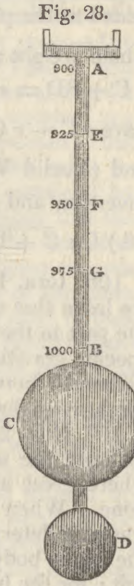
116. The hydrometer of Fahrenheit, which is one of the simplest that has been constructed, is represented in fig. 28, and may be formed either of glass or metal. A B is a cylindrical stem, and C, D two hollow balls appended to it. Into the lower ball D is introduced a quantity of mercury, sufficient to make the ball C sink to F, a little below the surface of distilled water. If this apparatus be plunged into a fluid lighter than water, the ball C will sink farther below the surface; and, if it be immersed in a heavier fluid, it will rise nearer the surface. In this way we can tell whether one fluid is more or less dense than another. But in order to determine the real specific gravities of the fluids, the hydrometer must either be loaded with different weights, or have a scale A B engraven on its stem. The former of these methods was employed by Fahrenheit. Having placed some small weights on the top A, he marked any point E, to which the instrument sunk in distilled water. By weighing the instrument thus loaded, he found the weight of a quantity of water equal to the part immersed (92). When the hydrometer was placed in a fluid denser than water, he loaded it with additional weights till it sunk to the same point E. The weight of the hydrometer being again found, gave him the weight of a quantity of the denser fluid equal to the part immersed; but as the part immersed was the same in both cases, the weights of the hydrometer were equal to the absolute weights of equal quantities of the two fluids; and, consequently, the specific gravities of the water and the other fluid were in the ratio of these weights. When the fluid, whose density is required, has less specific gravity than water, some of the weights are to be removed from the top A, till the instrument sinks to E; and the density of the fluid to be determined as before.

Hydrometer with weights.

—Instead of making the weight of the hydrometer variable, it is more simple, though less accurate, to have a scale of equal parts upon the stem AB. In order to graduate this scale, immerse the hydrometer in distilled water, at the temperature of 60° Fahrenheit, so that it may sink to B near the bottom of the stem, which may be easily effected, by diminishing or increasing the quantity of mercury in the ball D. At B place the number 1.000, which shews that every fluid, in which the hydrometer sinks to B, has its specific gravity 1.000, or that of distilled water. The hydrometer is then to be plunged in another fluid less dense than water, suppose oil, whose specific gravity may be .900, and the point A marked, to which it sinks. Every fluid, therefore, in which the hydrometer sinks to A, has its specific gravity .900; and if the scale AB be divided into equal parts, every intermediate degree of specific gravity between .900 and 1.000 will be marked. If the scale AB be divided into four parts in the points E, F, G, the fluid in which the hydrometer sinks to G will have .975 for its specific gravity; the specific gravity of that in which it sinks to F will be .950, and so on with the other points of division. If it is required to extend the range of the instrument, and to make it indicate the densities of fluids specifically lighter than water, we have only to load it in such a manner as to make it sink to the middle of the scale F in distilled water; and by taking two fluids, between whose densities the specific gravity of every other fluid is contained, excepting mercury and metals in a fluid state, to determine, as before, the extremities of the scale.

Hydrometer with an engraved scale.

Fig. 28.



Theorem for hydrometers in which the weight is variable.

117. When the weight of the hydrometer is variable, let E be the point to which it sinks in two different fluids; and let W be the absolute weight necessary to make it sink to E in the denser fluid, and $W \pm p$ the weight necessary to make it sink to the same point in the lighter fluid. Let S, s be the specific gravities of the two fluids, and V the volume of the part of the hydrometer that is constantly immersed. Then (99.) $W = \overline{S \times V}$, $W \pm p = s \times V$.

From the first equation we have, $V = \frac{W}{S}$, and from the

Of Specific Gravities.

second equation $V = \frac{W \pm p}{s}$, consequently $\frac{W \pm p}{s} = \frac{W}{S}$, and by reduction $s = \frac{s \times \overline{W \pm p}}{W}$. Thus, by knowing W and the weight p, and also S the specific gravity of one of the fluids, which will be 1.000 if that fluid be water, we can find s the specific gravity of the other fluid.

Theorem for hydrometers in which the weight is constant.

118. When the weight of the hydrometer is constant, and the density of the fluid indicated by the depth to which it descends, let F, E be the points to which it sinks in two different fluids, whose specific gravities are S, s, W the absolute weight of the hydrometer, V the volume of the part immersed when the hydrometer has sunk to E, and v its volume when sunk to F. Then (99.), we have $W = S \times V$, and $W = s \times v$, consequently $s \times v = S \times V$, and $s = \frac{S \times V}{v}$. If the absolute weight W, therefore, of the hydrometer be known, and also the volumes V, v, and the specific gravity S of one of the fluids, which may be water, the specific gravity of the other fluid may be determined by the preceding formula. When the figure of the hydrometer is regular, the volumes V, v, may be determined geometrically; but as the instrument is generally of an irregular form, the following methods should be employed:

Jones's Hydrometer.

Jones's hydrometer.

119. The hydrometer invented by Mr William Jones of Holborn, is a simple and accurate instrument, and requires only three weights to discover the strengths of spirituous liquors from alcohol to water. Like other instruments of the same kind, it is adjusted to the temperature of 60° of Fahrenheit; but as every change of temperature produces a change in the specific gravity of the spirits, Mr Jones found it necessary to attach a thermometer to the instrument, and thus make a proper allowance for every variation of temperature. Almost all bodies expand with heat and contract with cold; and as their volume becomes different at different temperatures, their specific gravities must also (86.) be variable, and will diminish with an increase of temperature. M. Homberg, and M. Eisenschmed found that the absolute weight of a cubic inch of brandy was four drams 42 grains in winter, and only four drams 32 grains in summer, and that the difference in spirits of nitre was still greater. It has been found, indeed, upon an average, that 32 gallons of spirits in winter will expand to 33 gallons in summer. As the strength of spirituous liquors is inversely as their specific gravities, they will appear much stronger in summer than in winter. This change in their strength had been formerly estimated in a rough way; but by the application of the thermometer, and by adjusting its divisions experimentally, Mr Jones has reduced it to pretty accurate computation. It has already been stated (109.) that where two substances are combined, the magnitude of the compound body is sometimes greater and sometimes less than the sum of the magnitudes of the two ingredients, and that this mutual penetration particularly happened in the mixture of alcohol and water. In strong spirits, this concentration is sometimes so great, as to produce a diminution of four gallons in the 100; for if to 100 gallons of spirit of wine found by the hydrometer to be 66 gallons in the 100 over proof, you add 66 gallons of water to reduce it to proof, the mixture will consist only of 162 gallons instead of 166 of proof spirits. This mutual penetration of the particles of alcohol and water has also been considered in Mr Jones's hydrometer, which we shall now describe with greater minuteness.

Of Specific Gravities.

120. In fig. 29. the whole instrument is represented with the thermometer attached to it. Its length AB is about $9\frac{1}{2}$ inches: the ball C is made of hard brass, and nearly oval, having its conjugate diameter about $1\frac{1}{2}$ inches. The stem AD is a parallelopiped, on the four sides of which the different strengths of spirits are engraved: the three sides which do not appear in fig. 29. are represented in fig. 30. with the three weights numbered 1, 2, 3, corresponding with the sides similarly marked at the top. If the instrument, when placed in the spirits, sinks to the divisions on the stem without a weight, their strength will be shewn on the side AD marked 0 at the top, and any degree of strength from 74 gallons in the 100 to 47 in the 100 above proof, will thus be indicated. If the hydrometer does not sink to the divisions without a weight, it must be loaded with any of the weights 1, 2, 3, till the ball C is completely immersed. If the weight No. 1. is necessary, the side marked 1 will shew the strength of the spirits, from 46 to 13 gallons in the 100 above proof. If the weight No. 2. is employed, the corresponding side will indicate the remainder of overproof to *proof*, marked P in the instrument, and likewise every gallon in 100 under proof, down to 29. When the weight No. 3. is used, the side similarly marked will shew any strength from 30 gallons in the 100 under proof, down to water, which is marked W in the scale. The small figures as 4 at 66, $3\frac{1}{2}$ at 61, $2\frac{1}{2}$ at 48 (fig. 29.) indicate the diminution of bulk which takes place when water is mixed with spirits of wine in order to reduce it to proof: thus, if the spirit be 61 gallons in the 100 over proof, and if 61 gallons of water are added in order to render it proof, the magnitude of the mixture will be $3\frac{1}{2}$ gallons less than the sum of the magnitudes of the ingredients, that is, instead of being 161 it will be only $157\frac{1}{2}$ gallons. The thermometer F connected with the hydrometer, has four columns engraved upon it, two on one side as seen in the figure, and two on the other side. When any of the scales upon the hydrometer, marked 0, 1, 2, 3, are employed, the column of the thermometer similarly marked must be used, and the number at which the mercury stands carefully observed. The divisions commence at the middle of each column which is marked 0, and is equivalent to a temperature of 60° of Fahrenheit; then, whatever number of divisions the mercury stands above the zero of the scale, the same number of gallons in the 100 must the spirit be reckoned weaker than the hydrometer indicates, and whatever number of divisions the mercury stands below the zero, so many gallons in the 100 must the spirit be reckoned stronger.

Fig. 29.

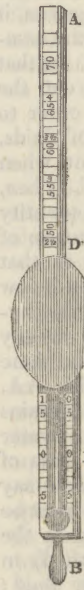
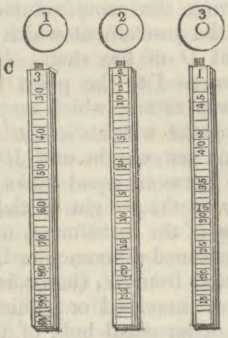


Fig. 30.



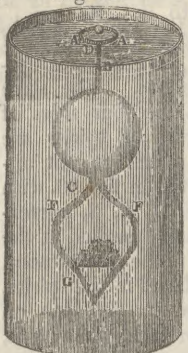
Nicholson's Hydrometer.

Nicholson's hydrometer.

121. A considerable improvement on the hydrometer has lately been made by Mr Nicholson, who has rendered it capable of ascertaining the specific gravities both of solids and fluids. F is a hollow ball of copper attached to the dish AA by a stem B, made of hardened steel. To the lower extremity of the ball is affixed a kind of iron stirrup FF, carrying another dish G of such a weight as to keep the stem vertical when the instrument is afloat. The parts

Of Specific Gravities.

Fig. 31.



of the hydrometer are so adjusted, that when the lower dish G is empty, and the upper dish AA contains 1000 grains, it will sink in distilled water at the temperature of 60° of Fahrenheit, so that the surface of the fluid may cut the stem DB at the point D. In order to measure the specific gravities of fluids, let the weight of the instrument, when loaded, be accurately ascertained. Then, this weight is equal to that of a quantity of distilled water at the temperature of 60°, having the same volume as that part of the instrument which is below the point D of the stem. If the hydrometer, therefore, is immersed to the point D in any other fluid of the same temperature, which may be done by increasing or diminishing the weights in the dish AA, the difference between this last weight and 1000 grains will express the difference between equal bulks of water and the other fluid. Now as the weight of the mass of water is equal to the weight of the instrument, which may be called W, the above-mentioned difference or D must be either added to or subtracted from W, (according as the weight in the dish AA was increased or diminished) in order to have the weight of an equal bulk of the fluid; then $W \pm D$ will be to W as the specific gravity of the given fluid is to that of water. This ratio will be expressed with considerable accuracy, as the cylindrical stem of the instrument being no more than $\frac{1}{40}$th of an inch in diameter, will be elevated or depressed nearly an inch by the subtraction or addition of $\frac{1}{10}$ of a grain, and will, therefore, easily point out any changes of weight, not less than $\frac{1}{20}$ of a grain, or $\frac{1}{20000}$ of the whole, which will give the specific gravities to five places of figures. The solid bodies whose specific gravities are to be determined by this hydrometer, must not exceed 1000 grains in weight. For this purpose, immerse the instrument in distilled water, and load the upper dish AA till the surface of the water is on a level with the point D of the stem. Then, if the weights required to produce this equilibrium be exactly 1000 grains, the temperature of the water will be 60° of Fahrenheit; but if they be greater or less than 1000 grains, the water will be colder or warmer. After noting down the weight necessary for producing an equilibrium, unload the upper dish, and place on it the body whose specific gravity is required. Increase the weight in the upper dish, till the instrument sinks to the point D, and the difference between this new weight and the weight formerly noted down, will be the weight of the body in air. Place the body in the lower dish G, and add weights in the upper dish till the hydrometer again sinks to D. This weight will be the difference between 1000 grains and the weight of the body in water; and since the weight of the body in air, and its weight in water, are ascertained, its loss of weight will be known, and consequently its specific gravity (96).

Wilson's Beads.

Wilson's, hydrometric beads.

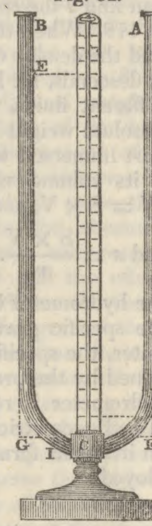
122. In order to determine the strength of spirits with the greatest expedition, Professor Wilson of Glasgow employed a very simple method. His hydrometer consists of a number of glass beads, the specific gravities of each of which vary in a known ratio. When the strength of any spirit is to be tried, the glass beads, which are all numbered, are to be thrown into it. Some of those whose specific gravity exceeds that of the spirit will sink to the bottom, while others will swim on the top, or remain suspended in the fluid. That which neither sinks to the bottom nor swims on the surface, will indicate by its number the specific gravity of the spirits (78). These beads have been greatly improved by Mrs Lovi, and are numbered in a variety of ways, either to shew specific gravities or the strength of spirits.

Of Specific Gravities.

Barometrical Areometer.

Barometrical areometer.

Fig. 32.



123. This name may be appropriately given to an instrument which is more useful for the purposes of illustration than of measurement. If two immisceable liquids are poured into a two-branched tube ABC, the one into the branch BC, and the other into the branch AC, till they balance each other, their specific gravities will be to one another inversely as the heights of each column. Thus, if we pour in mercury at A, and water at B, so that when the surface of the mercury is at D, that of the the water is at E, we shall find that if the column of mercury DF is two inches, that of the water EG will be 27 inches, and their specific gravities will be as 27 to 2, or as $13\frac{1}{2}$ to 1. If we pour in at B lintseed oil in place of water, the height EF will be 29 inches, and the specific gravity of the oil 0.931; because $\overset{\text{Feet.}}{27} : \overset{\text{In.}}{2} = 13\frac{1}{2} : 0.931$. By thus using mercury as the balancing column, the specific gravities of all fluids that do not mix with it, or act upon it, may be readily ascertained. The results thus obtained are not affected by the admission of the air at the open ends A and B, because the same weight of air presses upon the two balancing columns. But if we pour in mercury at A till the bent tube ACB contains above thirty inches of it, and close up the end A, and remove the air from above the mercury in AC, the column of mercury being no longer pressed down by the air in AC, will be pressed up to near the top of the tube AA by the pressure of the column of air in BC, and the instrument becomes a barometer, a column of air balancing a column of mercury. In this case, the tube BI becomes unnecessary, and the mercury may be enclosed in a glass ball at I, with an opening to admit the air.

Say's Stereometer.

Say's stereometer.

124. Captain M. K. Say, of the French Engineers, invented a very ingenious instrument for measuring the specific gravity of liquid bodies, soft bodies, *porous bodies*, and *powders*, as well as that of solids; and he published a detailed description of it, illustrated with various figures, in the *Annales de Chimie* for 1797.[1]

Many years afterwards, Professor Leslie brought forward the same instrument, under the name of a *Coniometer*, as a new invention, but without any variation of the principle. The following general description will give our readers an idea of the very beautiful principle on which this instrument is founded: Let AE be a glass tube, about three feet long, and open at both ends, the upper part AB being about 4-10ths, and the lower part BE about 2-10ths, of an inch in diameter. The upper edge of the tube is ground smooth, so that it can be shut air-tight by a piece of ground plate-glass, and the upper tube AB communicates with the lower one by a very narrow slit at B, which allows air to pass through it, but prevents sand or powder from passing.

The powder, sand for example, is put into the tube AB, and the lower tube BE is plunged into the open vessel F, containing mercury, till the mercury rises exactly within

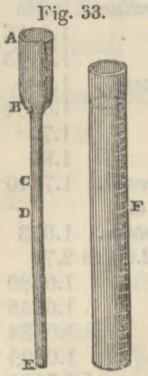
[1] See also *Nicholson's Journal*, 4to, vol. i. p. 325.

Of Specific Gravities.

the tube BE to the slit at B. The ground-glass cover is then placed air-tight upon the mouth A. There is now no air in the tube AE, except that which is mixed with the sand in the tube AB. If we now suppose that the atmospherical pressure indicated by the barometer is 30 inches, and elevate the tube AE till the mercury stands within it at a point C, 15 inches (one-half of 30), above its surface in the open vessel F, it is manifest that the air within the tube is pressed with exactly half an atmosphere, and therefore expands to twice its original bulk. Owing to this expansion of the air to twice its bulk, the tube AB contains only half the quantity of air which it did at first; and as the part BC contains the other half, the quantity of air in AB and BC is equal, as the air in BC is equal to the air that is mixed with the sand in AB, and fills the same space which the whole occupied previous to its expansion.

Let the sand be now removed from AB, and the same experiment repeated when the tube AB is filled with air. The quantity of air being now greater, will, when expanded to twice its bulk under a pressure of 15 inches, fill a larger space than BC, and the mercury will rise only to some point D. But as the expanded air in E occupies exactly the very same space in BC or BD that the whole occupied in AB under the ordinary atmospheric pressure of 30 inches, it follows that the cavity CD = BD — BC is equal to the bulk of the solid matter in the sand or powder. If we now find the number of grains of water held by the part CD of the tube, we determine at once the quantity of water equal in bulk to the solid matter in the sand or powder; and by comparing this with the weight of the sand, we obtain its exact specific gravity.

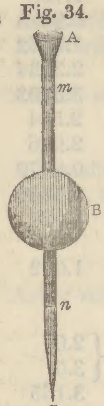
Fig. 33.



Brewster's Staktometer.

Brewster's staktometer.

Fig. 34.



125. The Staktometer, or *drop-measurer*, is shewn in fig. 34, where ABC is a glass vessel four or five inches long, having a hollow bulb B about half an inch in diameter. The instrument is filled by suction, and the fluid is discharged at C till it stands nearly at the point m, the zero of the scale. The fluid is then allowed to discharge itself at C by drops, and the number of them is counted till the surface of the fluid descends to another fixed point n. The experiment is then carefully repeated at different temperatures, till the number of drops of distilled water occupied by the cavity between m and n is accurately determined for various temperatures. The same experiment is made with alcohol. Thus, if N is the number of drops of distilled water whose specific gravity is $S_{,}$, and n the number of drops of alcohol whose specific gravity is $s_{,}$, and d the number of drops of any other mixture of alcohol and water contained in the same cavity $m\,n$, we shall have $n - N : S - s = d - N : \frac{(d - N)(S - s)}{n - N}$; and therefore $S - \frac{(d - N)(S - s)}{n - N}$ will be the specific gravity of the mixture required.

With a small instrument, the number of drops of *water* between m and n was 724, whereas the number of drops of ordinary proof spirits was 2117 at 60° Fah. Now, as the specific gravity of the spirits was .920, and that of water 1.000, we have a scale of 1393 drops for measuring all specific gravities between .920 and 1000, an unit in the fourth place of decimals corresponding to a variation of about two drops. From this experiment it follows that the bulk of a drop of water will be about 2.93 times as large as the bulk of a drop of the spirits.

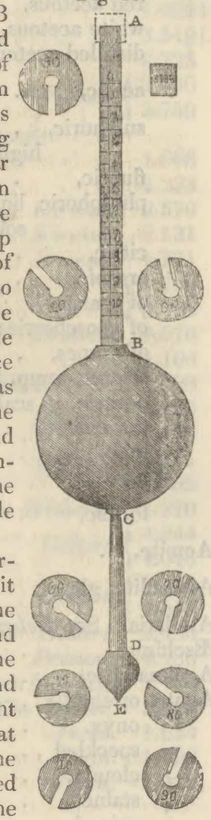
Of Specific Gravities.

Sikes's Hydrometer.

Sikes's hydrometer

126. This instrument, which is used in the collection of the revenue of the United Kingdom, is shewn in the annexed figure, where AB is a flat stem $3\frac{1}{2}$ inches long, divided on each side into eleven parts, each of which is divided into two. This stem carries a brass ball BC, into which is fixed the conical stem CD, terminating in a loaded bulb DE. Eight circular weights, numbered as in the figure, can be placed on the conical stem CD. The square weight can be placed on the top of the stem. When the strength of spirits is to be measured, a weight is to be placed on CD capable of sinking the ball BC till the fluid surface cuts the stem AB. The number at the place where the stem is cut by the fluid, as seen from below, is then added to the number on the weight employed; and with this sum at the side, and the temperature of the spirits at the top, the strength per cent. is found in a table which accompanies the instrument.

Fig. 35.



The square weight shews the difference between the weight of proof spirit and that of water, as described in the first clause of the hydrometer act; and it is exactly *one-twelfth* part of the total weight of the hydrometer and weight 60. When this square weight is placed on the summit of the stem at A, and the instrument loaded with the weight No. 6, it will sink in distilled water at the temperature 51° to the proof point P, at that temperature, as indicated on the narrow edge of the stem.

SECT. III. *On Tables of Specific Gravities.*

Table of specific gravities.

127. As the knowledge of the specific gravities of bodies is of great use in all the branches of mechanical philosophy, we have given the following table, comprehending the greater part of Brisson's tables, and one of the most extensive that has yet been published. When the specific gravities of any substance, as determined by different authors, seem to be at variance, the different results are frequently given, and the names of the observers prefixed by whom these results were obtained. The substances in the table have, contrary to the usual practice, been disposed in an alphabetical order. This was deemed more convenient for the purposes of reference, than if they had been divided into classes, or arranged according to the order of their densities.

The specific gravities of newly discovered minerals have been collected and inserted. The numbers are given in relation to water whose specific gravity is 1.000, excepting in the case of the gases, whose specific gravities are given in relation to that of atmospheric air, which is taken at 1.00.

Of Specific Gravities.

TABLE OF SPECIFIC GRAVITIES.

A

		Spec. Grav.
Acacia, inspissated juice of,		1.5153
Acid, nitric,		1.2715
nitric, highly concentrated,		1.583
muriatic,		1.2847
red acetous,		1.0251
white acetous,		1.0135
distilled acetous,		1.0095
acetic,		1.007 / 1.0095
sulphuric,		1.8409
highly concentrated,		2.125
fluoric,		1.500
phosphoric, liquid,		1.417
solid		2.852
citric,		1.0345
arsenic,		3.391
of oranges,		1.0176
of gooseberries		1.0581
of grapes,		1.0241
selenic, temp. 329°,		2.524
boracic, in scales,		1.475
do. melted,		1.803
molybdic,		3.460
benzoic,		0.667
formic,		1.102 / 1.113
Acmite,		3.24
Actinolite, glassy,	*Kirwan.*	2.950 / 3.903
Adularia. See *Felspar.*		
Æschinite,		5.14
Agalmatolite,		2.800
Agate, oriental,		0.5901
onyx,		2.6375
speckled,		2.607
cloudy,		2.6253
stained,		2.6324
veined,		2.6667
Icelandic,		2.348
of Havre,		2.5881
jasper,		2.6356
Mocha,		2.5891
iridescent,		2.5535
Air, atmospheric,		
Barom. 29.75, Thermom. 32.		0.00122
Barom. 29.85, Thermom. 54°.5	*Lavoisier.*	0.0012308
Alabaster of Valencia,		2.638
veined,		2.691
of Piedmont,		2.693
of Malta,		2.699
yellow,		2.699
Spanish saline,		2.713
oriental white,		2.730
ditto, semi-transparent,		2.762
stained brown,		2.744
of Malaga, pink,		2.8761
of Dalias,		2.6110
Albite,		2.624
Alcohol, absolute,	*Lowitz.*	0.791
highly rectified,		0.8293
commercial,		0.8371
15 parts, Water 1 part,		0.8527
14 — 2		0.8674

		Spec. Grav.
Alcohol, 13 parts, Water 3 parts,		0.8815
12 — 4		0.8947
11 — 5		0.9075
10 — 6		0.9199
9 — 7		0.9317
8 — 8		0.9427
7 — 9		0.9519
6 — 10		0.9594
5 — 11		0.9674
4 — 12		0.9733
3 — 13		0.9791
2 — 14		0.9852
1 — 15		0.9919
Alder-wood,	*Muschenbroek.*	0.8000
Allanite,	*Jardine.*	3.665
Aloes, hepatic,		1.3586
socotrine,		1.3795
Allophane,	*Stromeyer.*	1.889
Alouchi, an odoriferous gum,		1.0604
Alum,		1.75
soda,		1.88
Alumine, sulphate of,	*Mushenbroek.*	1.7140
saturated solution of, temp. 42°,	*Watson.*	1.033
Alunite,		2.69 to 2.74
Amber, yellow transparent,		1.0780
opaque,		1.0855
red,		1.0834
green,		1.0829
Ambergris,		0.7800 / 0.9263
Amblygonite,		2.95
Amethyst, common. See *Rock* crystal.		2.750
Amianthus, long,		0.9088
penetrated with water,		1.5662
short,		2.3134
penetrated with water,		3.3803
Amianthinite from Raschau,		2.584
Bayreuth,		2.916
Ammonia, liquid,		0.8970
muriate of,	*Muschenbroek.*	1.4530
	Ure.	1.521
saturated solution of, temp. 42°,	*Watson.*	1.072
Amphibole. See *Hornblende* basaltic.		
Amphigene. See *Leucite.*		
Analcime,		2.0 / 3.0
Andalusite, or hardspar	*Haüy.*	3.165
Anhydrite, or Muriacite,		2.5. to 2.95
Anime, oriental,		1.0284
occidental,		1.0426
Anorthite,		2.656
Anthophyllite,		3.20
Antimony, glass of,		4.9464
in a metallic state, fused,		6.624 / 6.860
native,	*Klaproth.*	6.720
grey,		4.3
sulphur of,		4.0643
ore, grey and foliated,	*Kirwan.*	4.368
radiated,	*Kirwan.*	4.440
red,	*La Métherie.*	3.750
	Klaproth.	4.090
Apatite. See *Phosphorite.*		
Aplome		3.45

Of Specific Gravities.

		Spec. Grav.
Apophyllite. See *Fish Eye Stone*.		
Apple-tree, wood of the,	*Muschenbroek.*	0.7930
Aquamarine. See *Beryl*.		
Arcanson,		1.0857
Areca, inspissated juice of,		1.4573
Arctizite, or Wernerite,	*Dandrada.*	3.606
Argillite, or slate clay,	*Kirwan.*	2.600 / 2.680
Arnotto,		0.5956
Arragonite,	*Haüy.*	2.946
	Thenard and *Biot.*	2.9267
	Malus.	2.94686
Arsenic bloom, Pharmacolite,	*Klaproth.*	2.640
fused,	*Bergman.*	8.310
native,	*Kirwan.*	5.670
	La Métherie.	5.600
	Brisson.	6.522
glass of (arsenic of the shops),		3.5942
Arsenical pyrites, or Mispickel,		6.5
See *Realgar*.		
Asbestinite,	*Kirwan.*	3.000 / 3.310
Asbestos, mountain cork,	*Bergman.*	0.6806 / 0.9933
penetrated with water,		1.2492 / 1.3492
ripe,	*Brisson.*	2.5779
penetrated with water,		2.6994
starry,		3.0733
penetrated with water,		3.0808
unripe,		2.9958
penetrated with water,		3.0343
Ash trunk,	*Muschenbroek.*	0.8450
dry,	*Turin.*	0.800
Asphaltum, cohesive,		1.450 / 2.060
compact,		1.070 / 1.165
Assafœtida,		1.3275
Aventurine, semitransparent,		2.6667
opaque,		2.6426
Augite, or Pyroxene,	*Haüy.*	3.226
	Werner.	3.471
	Reuss.	3.777
Automalite, Gahnite, or Fahlunite,		4.200
Axinite, or Thumerstone,		4.690
	Haüy.	3.213 / 3.296
	Gerard.	3.250
Azure stone, or lapis lazuli,	*Brisson.*	2.7675
	Kirwan.	2.896
oriental,		2.7714
of Siberia,		2.9454

B

		Spec. Grav.
Barolite, or Witherite. See *Barytes*, Carbonate of.		
Barytes, or Baroselenite,		4.400 / 4.865
white,		4.4300
grey,		4.4909
rhomboidal,		4.4434
octaedral,		4.4712
in stalactites,		4.2984
sulphate of, native,	*Kirwan.*	4.000 / 4.460
	Malus.	4.48141
carbonate of, native,		4.300 / 4.338
Baryto-calcite,		3.66
Basalt,	*Kirwan.*	2.979
Basalt,	*Bergman.*	3.000
from the Giant's Causeway,		2.864
prismatic, from Auvergne,		2.4215
of St Tubery,		2.7948
Baras, a juice of the pine		1.0441
Bay-tree, Spanish,	*Muschenbroek.*	0.8220
Bdellium,		1.1377
Beech-wood,	*Muschenbroek.*	0.8520
Beer, red,		1.0338
white,		1.0231
Benzoin,		1.0924
Beryl, oriental,		3.5491
occidental,		2.723
or aquamarine,	*Werner.*	2.650 / 2.759
schorlous, or shorlite. See *Pycnite*.		
Bezoar, oriental,		1.666
occidental,		2.233
Bismuth, native,	*Kirwan.*	9.570
sulphuretted,	*Kirwan.*	6.131
ochre,	*Brisson.*	4.371
in a metallic state, fused,		9.756 / 9.822
Bismuth,	*Brisson.*	9.070
Bitumen of Judea,		1.104
Black-coal, pitch-coal,	*Wiedemann.*	1.308
slate-coal, English,	*Kirwan.*	1.250 / 1.370
Bielschowitz,	*Richter.*	1.321 / 1.382
cannel coal,	*La Métherie.*	1.270
Blende, yellow,	*Gellert.*	4.044 / 4.048
brown, foliated,	*Gellert.*	3.770 / 4.048
black,	*Gellert.*	3.930
	Brisson.	4.166
auriferous from Nagyag,	*Van Muller.*	5.398
Blood, human,	*Jurin.*	1.054
crassamentum of	*Jurin.*	1.126
serum of	*Jurin.*	1.030
Blood-Stone. See *Heliotrope*.		
Boles,	*Kirwan.*	1.400 / 2.000
Bone of an ox,		1.656
Boracite,	*Westrumb.*	2.566 to 3.000
Borax,		1.740
saturated solution of, temp. 42°,	*Watson.*	1.010
Bournonite,		5.576
Boxwood, French,	*Muschenbroek.*	0.9120
Dutch,	*Muschenbroek.*	1.3280
dry,	*Jurin.*	1.030
Brass common, cast,		7.824
wiredrawn,		8.544
cast, not hammered,	*Brisson.*	8.395
Brazil wood, red,	*Muschenbroek.*	1.0310
Brewsterite,		2.1 to 2.4
Bronzite,		3.201
Brick,		2.000
Bromine,		3.000
Bustamite,		3.12 to 3.23
Butter,		0.9423

C

		Spec. Grav.
Cacao butter,		0.8916
Cachibou, gum,		1.0640
Cadmium (metal) not crushed,	*Stromeyer.*	8.6040
crushed,		8.6944
Calamine,	*Brisson.*	3.525

Of Specific Gravities.

		Spec. Grav.
Calamine,	*La Métherie.*	4.100
Calcareous spar. See *Spar*.		
Calculi, urinary,		1.700 1.240 1.434
Campeachy wood, or logwood,	*Muschenbroek.*	0.9130
Camphor,		0.9887
Caoutchouc, elastic gum, or India rubber,		0.9335
Caragna, resin of the Mexican tree caragna,		1.1244
Carbon of compact earth,		1.3292
Carnelian, stalactite,		2.5977
speckled,		2.6137
veined,		2.6234
onyx,		2.6227
pale,		2.6301
pointed,		2,6120
arborized,		2.6133
Cat's eye,	*Klaproth.*	2.600 2.625
grey,		2.5675
yellow,		2.6573
blackish,		3.2593
Catchew, juice of an Indian tree,		1.3980
Caustic ammoniac, solution of, or fluid volatile alkali,		0.897
Cedar tree, American,	*Muschenbroek.*	0.5608
wild,	*Muschenbroek.*	0.5608
Palestine,	*Muschenbroek.*	0.5960
Indian,	*Muschenbroek.*	1.3150
Celestine. See *Strontian*, sulphate of.		
Cerite,		4.500
Ceylanite, or Pleonaste,	*Haüy.*	3.765 3.793
Chabasie,	*Haidinger.*	2.041
	Mohs.	2.100
Chalcedony, bluish,		2.5867
onyx,		2.6151
veined,		3.6059
transparent,		2.6640
reddish,		2.6645
common,	*Kirwan,*	2.600 2.655
Chalk,	*Muschenbroek.*	2.252
	Watson.	2.657
Cherry-tree,	*Muschenbroek.*	0.7150
Chiastolite. See *Macle*.		
Chlorite,		2.775
Chloropal,		2.000
Chrysoberyl. See *Cymophane*.		
Chrysolite of the jewellers,	*Brisson.*	2.782
of Brazil,		2.692
	Werner.	3.340 2.410
Chrysoprase, a variety of Chalcedony,		2.489 3.250
Crystal. See *Rock Crystal*.		
Crystalline lens,		1.100
Cimolite,		2.0
Cinnabar, dark red, from Deux-Ponts.	*Kirwan.*	7.786
from Almaden,	*Brisson.*	6.902
crystallized,	*Brisson.*	10.218
hepatic,		7.1
Cinnamon, volatile oil of,		1.044
Cinnamon-stone,		2.6
Citron-tree,	*Muschenbroek.*	0.7263
Clinkstone,	*Klaproth.*	2.575 2.620
Cloves, volatile oil of,		1.036
Cobalt, in a metallic state, fused,		7.645 7.811

		Spec. Grav.
Cobalt ore, grey,	*Haüy.*	5.511 7.721
	Kirwan.	5.309
earthy, black, indurated,	*Gellert.*	2.019 2.425
vitreous oxide of		2.4405
Cocoa wood,	*Muschenbroek.*	1.0403
Coccolite,	*Dandrada.*	3.316
Columbium,	*Hatchet.*	5.918
Condrodite,		3.14 to 3.19
Copal, opaque,		1.1398
transparent,		1.0452
Madagascar,		1.0600
Chinese,		1.0628
Copper, native,	*Kirwan.*	7.600 7.800
from Siberia,	*Haüy.*	8.5084
Hungary,	*Gellert.*	7.728
ore, compact vitreous,	*Kirwan.*	4.129
Cornish,	*Kirwan.*	5.452
purple, from Bannat,	*Kirwan.*	4,956
from Lorraine,	*La Métherie.*	4.300
	Kirwan.	4,983
	Wiedemann.	5.467
glance,		5.6
pyrites,	*Kirwan.*	4.080
	Brisson.	4.344
ore, white,	*La Métherie.*	4.500
grey,	*Haüy.*	4.865 4.5
yellow,		4.3
blue,		3.2 3.4
foliated, florid, red	*Wiedemann.*	3.950
azure, radiated,	*Wiedemann.*	3.231
	Brisson.	3.608
emerald,	*La Métherie.*	2.850
	Haüy.	3.300
muriate of,		4.0 4.3
arseniate of, hexahedral,		2.549
octahedral,		2.88
trihedral,		4.2
prismatic,		4.2
partial arseniate,		3.4
sulphate of, crystallised,	*Ure.*	2.3438
saturated solution of sulphate of, temp. 42°,	*Watson.*	1,150
drawn into wire,		8.878
fused,		7.788
	Hatchet.	8.985
Copper sand, muriate of copper,	*La Métherie.*	3.750
	Herrgen.	4.431
Cork,	*Muschenbroek.*	0.2400
Corundum of India,	*Klaproth.*	3.710
	Bournon.	3.875
of China,		3.981
Cross stone. See *Harmotome*.		
Cryolite,		2.963
Cube iron-ore,	*Bournon.*	3.000
spar,	*Haüy.*	2.964
Cubizite. See *Analcime*.		
Cyanite, Sappare, or Disthene,	*Saussure jun.*	3.517
	Hermann.	3.622
Cyder,		1.0181
Cymophane, or Chrysoberyl,	*Werner.*	3.600 3.720
	Haüy.	3.796
Cypress wood, Spanish,	*Muschenbroek.*	0.6440

Of Specific Gravities.

		Spec. Grav.
D		
Datholite, from Arendal,		2.989
Dipyre,		2.63 – 2.84
Diallage. See *Smaragdite.*		
Diamond, oriental, colourless,		3.5212
rose-coloured,		3.5310
orange-coloured,		3.5500
green-coloured,		3.5238
blue-coloured,		3.5254
Diamond, Brazilian,		3.4444
yellow,		3.5185
orange,	*Haüy.*	3.55
Dichroite. See *Iolite.*		
Disthene. See *Cyanite.*		
Dolomite,		2.859
Dragon's blood,		1.2045
E		
Ebony, Indian,	*Muschenbroek.*	1.2090
American,	*Muschenbroek.*	1.3310
Edingtonite,		2.710
Elder tree,	*Muschenbroek.*	0.6950
Elemi,		1.0182
Elm trunk,	*Muschenbroek.*	0.6710
Emerald,	*Gahn and Berzelius.*	2.673 – 2.683
	Werner.	2.600
	Haüy.	2.723
of Brazil,		3.1555
pseudo,	*Gahn and Berzelius.*	2.701
Epidote. See *Zoisite.*		
Epistilbite,	*Rose.*	2.749
Ether, sulphuric,		from 0.716 to 0.745
nitric,		0.9088
muriatic,		0.7296
acetic,		0.8664
Euchroite,		3.389
Euclase,	*Haüy.*	3.0625
Eudialyte,		2.898
Euphorbium gum,		1.1244
F		
Fahlunite. See *Automalite.*		
Fat of beef,		0.9232
veal,		0.9342
mutton,		0.9235
hogs,		0.9368
Felspar, fresh,	*Haüy.*	2.438
Adularia,	*Struve.*	2.500 – 2.600
Labrador stone,	*Brisson.*	2.607 – 2.704
glassy,		2.518 – 2.589
Fergusonite,		5.838
Fettstein,	*Borkowski.*	2.563
	Haüy.	2.614
Filbert tree,	*Muschenbroek.*	0.6000
Fir, male,	*Muschenbroek.*	0.5500
female,	*Muschenbroek.*	0.4980
Fish-eye stone, Ichthyophalmite, or Apophyllite,		2.5782
	Haüy.	2.467
Flint,	*Blumenbach.*	2.594
olive,		2.6057

Of Specific Gravities.

		Spec. Grav.
Flint, spotted,		2.5867
onyx,		2.6644
of Rennes,		2.6538
of England,		2.6087
variegated of Limosin,		2.2431
veined,		2.6122
Egyptian,		2.5648
black,		2.582
Fluor-spar. See *Spar.*		
Franklinite,		5.03
G		
Gabbronite,		2.94
Gadolinite,		4.00 – 4.20
Gahnite. See *Automalite.*		
Galbanum,		1.2120
Galena. See *Lead-glance.*		
Galipot, a juice of the pine,		1.0819
Gamboge,		1.2220
Garnet, precious, of Bohemia,	*Klaproth.*	4.085
		4.188
	Werner.	4.230
	Kastner.	4.352
volcanic, 24 faces.		2.468
of Syria,		4.000
in dodecahedral crystals,		4.0637
common,	*Werner.*	3.576
	Kastner.	3.688
Gas, atmospheric,[1] or common air,		1.000
phosgene, or chloro-carbonic gas,	*J. Davy.*	3.3888
nitrous acid gas, calculated,	*Gay Lussac.*	3.176
	Sir H. Davy.	2.427
vapour of sulphuret of carbon,	*Gay Lussac.*	2.6447
sulphuric ether,	*Gay Lussac.*	2.5860
iodine calculated,	*Gay Lussac.*	8.6195
hydriodic ether,	*Gay Lussac.*	5.4749
oil of turpentine,	*Gay Lussac.*	5.0130
hydriodic acid gas,	*Gay Lussac.*	4.4430
fluosilicic acid gas,	*John Davy.*	3.5737
chlorine,	*Gay Lussac* and *Thénard.*	2.470
euchlorine,	*Sir H. Davy.*	2.409
	Gay Lussac.	2.3144
fluoboracic gas,	*J. Davy.*	2.3709
vapour of muriatic ether,	*Thenard.*	2.219
chloro-cyanic vapour,	*Gay Lussac.*	2.111
sulphurous acid,	*Sir H. Davy.*	2.193
	Gay Lussac and *Thénard.*	2.1204
vapour of alcohol,	*Dalton.*	2.1
absolute alcohol,	*Gay Lussac.*	1.613
cyanogen,	*Gay Lussac.*	1.806
nitrous oxide, or prolixite of azote,	*Sir H. Davy.*	1.614
	Colin.	1.5204
carbonic acid,	*Saussure.*	1.518
	Allan and *Pepys.*	1.524
	Biot and *Arago.*	1.51961
muriatic acid, or hydro-chloric gas,	*Sir H. Davy.*	1.278
	Biot and *Arago.*	1.2474
sulphuretted hydrogen,	*Gay Lussac.* and *Thenard.*	1.1912
	Sir H. Davy.	1.777
oxygen, mean,		1.104
	Saussure.	1.114

[1] The specific gravities of the gases are taken from Biot's *Traité de Physique*, tom. i. p. 383; from Gay Lussac's Tables in the *Annales de Chimie et de Physique*, vol. i. p. 218; and from Thomson's *Annals of Philosophy*, vol. i. p. 118. The measures for the gases, taken by MM. Biot and Arago, are calculated from Biot's formulæ. They are given in relation to atmospheric air, which is supposed to be unity.

Of Specific Gravities.

		Spec. Grav.
Gas, oxygen, mean,	*Kirwan* and *Lavoisier*.	1.103
	Biot and *Arago*.	1.0359
	Allan and *Pepys*.	1.127
	Berzelius and *Dulong*.	1.037
nitrous gas, or deutoxide of azote,	*Bérard*.	1.0388
	Sir H. Davy.	1.094
olefiant gas,	*Theodore, Saussure*.	0.97804
azote,	*Biot* and *Arago*.	0.96913
carbonic oxide,	*Cruickshank*.	0.9569
hydrocyanic vapour,	*Gay Lussac*.	0.9476
phosphuretted hydrogen,	*Sir H. Davy*.	0.870
steam,	*Tralles*.	0.6896
	Gay Lussac.	0.62349
ammoniacal,	*Sir H. Davy*.	0.590
	Biot and *Arago*.	0.59669
carburetted hydrogen,	*Thomson*.	0.555
	Sir H. Davy.	0.491
	Cruickshank.	0.678
	Dalton.	0.600
arsenical hydrogen,	*Trommsdorf*. *Dalton*.	0.529
phosphuretted hydrogen,	*Haüy*.	0.852
	Sir H. Davy.	0.435
hydrogen,	*Thomson*.	0.073
	Sir H. Davy.	0.074
	Biot and *Arago*.	0.072098
	Berzelius and *Dulong*.	0.6885
Gay Lussite,		1.96
Gehlenite,	*Fuchs*.	2.78
Gieseckite,		2.832
Girasol,	*Brisson*.	4.000
Glance-coal, slaty,	*La Métherie*.	1.300
	Klaproth.	1.530
Glass, crown of St Louis,	*Cauchoix, Biot*.	2.487
flint of M. Dartigues,	*Cauchoix, Biot*.	3.20
flint used by Mr Tully for his achromatic telescopes,		3.192 3.334 3.354 3.437
white flint,		3.00
crown,		2.520
common plate,		2.760
yellow plate,		2.520
white or French crystal,		2.8922
St Gobins,		2.4882
gall,		2.8548
bottle,		2.7325
Leith crystal,		3.189
green,		2.6423
borax,		2.6070
fluid,		3.329
of Bohemia,		2.3959
of Cherbourg,		2.5596
of St Cloud,		3.2549
animal,		2.5647
mineral,		2.2694
Glauberite,		2.73 to 2.80
Glaucina,		3.000
Gmelinite,		2.5 to 2.1
Gold, native,		17.00 19.00
pure, of 24 carats, fine, fused, but not hammered,	*Haüy*.	19.2587
the same hammered,		19.342
English standard, 22 carats, fine, fused, but not hammered,		18.888
guinea of George II.		17.150
guinea of George III.		17.629
Parisian standard, 22 carats, not hammered,		17.486
Gold, the same hammered,		17.589
Spanish gold coin,		17.655
Holland ducats,		19.352
trinket standard, 20 carats, not hammered,		15.709
the same hammered,		15.775
Portuguese coin,		17.9664
French money, 21⅔ carats, fused,		17.4022
coined,		17.6474
French, in the reign of Louis XIII.		17.5531
Granite, red Egyptian,		2.6541
grey Egyptian,		2.7279
beautiful red,		2.7609
of Girardmor,		2.7163
violet of Gyrogmagny,		2.6852
red of Dauphiny,		2.6431
green of Dauphiny,		2.6836
radiated of Dauphiny,		2.6678
red of Semur,		2.6384
grey of Bretagne,		2.7378
yellowish,		2.6136
of Carinthia, blue,	*Kirwan*.	2.9564
Granitelle,		3.0626
of Dauphiny,		2.8465
Graphic ore,	*Müller*.	5.723
Graphite. See *Plumbago*.		
Grenatite. See *Staurotide*.		
Gum Arabic,		1.4523
tragacanth,		1.3161
seraphic,		1.201
cherry-tree,		1.4817
Bassora		1.4346
Acajou,		1.4456
Monbain,		1.4206
Gutte,		1.2216
ammoniac,		1.2071
Gayac,		1.2289
liquid, from Botany Bay,	*Thomson*.	1.196
lac,		1.1390
animè, Eastern		1.0284
Western,		1.0426
Gunpowder in a loose heap,		0.836
shaken,		0.932
solid,		1.745
Gypsum, opaque,		2.1679
compact, specimen in the Leskean collection,		2.939
compact,		1.872 2.288
impure,		2.473
foliated, mixed with granular limestone,	*Kirwan*.	2.725
semitransparent,		2.3062
fine ditto,		2.2741
opaque,		2.2642
rhomboidal,		2.3114
ditto, 10 faces,		2.3117
cuneiform, crystallised,		2.3060
striated of France,		2.3057
of China,		2.3088
flowered,		2.3059
sparry opaque,		2.2746
semitransparent,		3.3108
Gypsum, granularly foliated, in the Leskean collection,	*Kirwan*.	2.900
mixed with marl, of a slaty form,		2.473

H

Harmotome, or Cross-Stone,		2.3333
Hazel,	*Muschenbroek*.	0.606

Of Specific Gravities.

		Spec. Grav.
Hauyne or Latialite,	*Gmelin.*	2.687
	Gismonde.	3.333
Heliotrope, or Blood-Stone,	*Kirwan.*	2.629 2.700
	Blumenbach.	2.633
Hematites. See *Ironstone.*		
Herschelite,		2.11
Hollow spar, Chiastolite,		2.944
Hone, razor, white,		2.8763
penetrated with water,		2.8839
razor, white and black,		3.1271
Honey,		1.4500
Honeystone, or Mellite,	*Haüy.*	1.586
	Abich.	1.666
Hopeite,		2.61
Hornblende, common,	*Kirwan.*	3.600 3.830
Schiller spar,	*Kirwan.*	2.882
schistose,	*Kirwan.*	2.909 3.155
basaltic,	*Reus.*	3.150 3.220
	Kirwan.	3.333
Hornstone, or petrosilex,		2.530 2.653
ferruginous,		2.813
veined,		2.747
grey,		2.654
blackish-grey,		2.744
yellowish-white,		2.563
bluish, and partly yellowish-grey,		2.626
dark purplish-red iron-shot,		2.638
greenish-white with reddish spots, from Lorraine,		2.532
iron shot, brownish-red, outside bluish, grey inside,		2.813
Humboldtite,		2.13
Hyalite,	*Kirwan.*	2.110
Hyacinth,	*Karsten.*	4.000
	Klaproth.	4.545 4.620
Hydrargillite. See *Wavellite.*		
Hydrogen, bicarburet of, at 60°,		0.85
Hyperstene. See *Bronzite.*		
Hypocist,		1.5263
Hyposulphite of lime,	*Herschel.*	1.0105

I

Jade, or Nephrite, white,		2.9592
green,		2.9660
olive,		2.9829
from the East Indies,	*Kirwan.*	2.977
of Switzerland,	*Brisson.*	3.310 3.389
combined with the boracic acid and boracited calx,		2.566
Jasmin, Spanish,	*Muschenbroek.*	0.7700
Jasper, veined,		2.6955
red,		2.6612
brown,		2.6911
yellow,		2.7101
violet,		2.7111
grey,		2.7640
cloudy,		2.7354
green,		2.6274
bright green,		2.3587
deep green,		2.6258
brownish-green,		2.6814
blackish,		2.6719
blood coloured,		2.6277

		Spec. Grav.
Jasper, onyx,		2.8160
flowered, red and white,		2.6228
red and yellow,		2.7500
green and yellow,		2.6839
red, green, and grey,		2.7323
red, green, and yellow,		2.7492
universal,		2.5630
agate,		2.6608
Idocrase. See *Vesuvian.*		
Jenite,		3.80 4.00
Jet, a bituminous substance,		1.2590
Indigo,		0.7690
penetrated with water,		1.0095
Inspissated juice of liquorice,		1.7228
Iodine,	*Thomson.*	3.0844
	Gay Lussac.	4.948
Iolite, or Dichroite,		2.56
Iridium. See *Osmium.*		
fused by galvanism,		18.68
Iron, native, meteoric,		6.48
chromate of, from the department of Var,		4.0326
from the Uralian mountains, in Siberia,	*Lauguier.*	4.0579
sulphate of, crystallized,	*Ure.*	1.7774
saturated solution, temp. 42°	*Watson.*	1.157
arseniate of,		3.000
fused, but not hammered,		7.200
forged into bars,		7.600 7.788
pyrites, dodecahedral,	*Hatchet.*	4.830
from Freyberg,	*Gellert.*	4.682
Cornwall,	*Kirwan.*	4.789
cubic,	*Brisson.*	4.702
radiated,	*Hatchet.*	4.698 4.775
magnetic,	*Haüy.*	4.518
white,		4.
sand, magnetic sand, from Virginia,		4.600
	Bergman.	7.800
magnetic,		4.200 4.900
ore specular,	*Kirwan.*	4.793 5.139
ore specular,	*Brisson.*	4.939 5.218
micaceous,	*Kirwan.*	4.728 5.070
Ironstone, red, ochry,	*Wiedemann.*	2.952
compact,	*Kirwan.*	3.423
from Siberia,	*Kirwan.*	3.760
Lancashire,	*Brisson.*	3.573
	Wiedemann.	3.863
compact, brown, from Bayreuth,	*Kirwan.*	3.551
from Tyrol,	*Kirwan.*	3.753
cubic,	*Brisson.*	3.503 3.477
red hematites,	*Kirwan.*	5.005
	Gellert.	4.740
brown hematites,	*Kirwan.*	3.951
	Gellert.	3.789
	Wiedemann.	4.029
sparry, or calcareous,	*Kirwan.*	3.640 3.810
	Brisson.	3.672
decomposed,	*Kirwan.*	3.300 3.600
black, compact,	*Wiedemann.*	4.076

Of Specific Gravities.

		Spec. Grav.
Ironstone, clay reddle,	*Brisson.*	3.139
	Blumenbach.	3.931
clay, lenticular,	*Kirwan.*	2.673
clay, common, from Cathina at Raschau,	*Kirwan.*	2.936
from Roscommon in Ireland,	*Rotheram.*	3.471
Carron in Scotland,	*Rotheram.*	3.205 3.357
clay, reniform iron-ore,	*Wiedemann.*	2.574
clay, pea-ore,	*Molinghof.*	5.207
Iron, native, (Heleachen mass)	*Monheim.*	6.723
ore, lowland, from Sprottau,	*Kirwan.*	2.944
Iserine, an oxide of titanium from the Iser in Bohemia,		4.500
Juniper tree,	*Muschenbroek.*	0.5560
Ivory, dry,		1.8250
Ivy gum, from the Hedera terrestris,		1.2948
K		
Keffekil, or Meerschaum,	*Klaproth.*	1.6090
Kinkina,	*Muschenbroek.*	0.7840
Knebelite,		3.714
Kyanite. See *Cyanite.*		
L		
Labdanum, resin,		1.1862
in tortis,		2.4933
Lapus lazuli. See *Azure stone.*		
Laumonite,		2.20
Lard,		0.9478
Latrobite,		2.720
Latialite. See *Hauyne.*		
Lead-glance, or galena, common,	*Gellert.*	7.290
from Derbyshire,	*Watson.*	6.565 7.786
compact,	*Gellert.*	6.886 7.444
	Kirwan.	4.319 5.052
crystallized,	*Brisson.*	7.587
radiated,	*La Métherie.*	5.500
from the Hartz,	*Kirwan.*	7.448
Kautenbach,	*Vauquelin.*	6.140
Kirschwalder,	*Vauquelin.*	5.820
ore, corneous,	*Chenevix.*	6.065
reniform,	*Bindheim.*	3.920
of black lead,		6.745
blue,	*Gellert.*	5.461
brown,	*Wiedemann.*	6.974
from Huguelgoet,	*Klaproth.*	6.600
	Haüy.	6.909
black,	*Gellert.*	5.770
white, from Leadhills,	*Chenevix.*	7.236
	Haüy.	6.559
phosphorated, from Wanlockhead,	*Klaproth.*	6.560
seleniated,		7.697
Zschoppau,	*Klaproth.*	6.270
Brisgaw,	*Haüy.*	6.941
red, or red lead spar,	*Bindheim.*	5.750
	Brisson.	6.027
sulphato-carbonate,		6.8 to 7.0
cupreous do.		6.4
Lead,	*Fischer, Wollaston.*	11.352
	Gellert.	11.445
arseniate of,		5.00 6.40
carbonate of,		6.00 7.20

		Spec. Grav.
Lead, muriate of,		7.07
murio-carbonate of,		6.00 to 6.1
sulphate of,		6.3
chromate of,		6.00
acetate of,	*Muschenbroek.*	2.3953
vitriol, from Anglesea,	*Klaproth.*	6.300
Lemon tree,	*Muschenbroek.*	0.7033
Lepidolite, lilalite,	*Klaproth.*	2.816
	Haüy.	2.854
Leucolite. See *Dipyre.*		
Leucite, or Amphigene,	*Klaproth.*	2.455 2.490
Lignum vitæ,	*Muschenbroek.*	1.3330
Limestone, compact,		1.3864 2.7200
foliated,		2.710 2.837
granular,		2.700 2.800
green,		3.183
arenaceous,		2.742
Linden wood,	*Muschenbroek.*	0.604
Lithomarge,		2.50
Logwood, or Campeachy wood,	*Muschenbroek.*	0.9130
M		
Macle, or chiastolite,		2.9444
Madder root,	*Muschenbroek.*	0.7650
Mahogany,		1.0630
Magnesia, sulphate of, crystallized use,	*Ure.*	1.7976
saturated solution, temp. 42°,	*Watson.*	1.232
native, hydrate of,		2.350
Magnesite, or carbonate of magnesia,		2.200
a new species, from Baumgarten in Silesia,	*Hausmann.*	2.95
Magnetic pyrites. See *Iron.*		
Malachite,	*Brisson.*	3.572
compact,	*Brisson.*	3.641
	Muschenbroek.	3.994
Manganese,	*Bergman.*	6.850
	Hielm.	7.000
grey ore of, striated,	*Brisson.*	4.249 4.756
	Rinmann.	4.181
grey, foliated,	*Hagen.*	3.742
red, from Kapnick,	*Kirwan.*	3.233
black,	*Dolomieu.*	2.0000 3.0000
	Brisson.	3.7076
scaly,		4.1165
sulphuret of,		3.95
white,		2.8
phosphate of,	*Vauquelin.*	3.439
	Ullman.	3.775
Maple wood,	*Muschenbroek.*	0.7550
Marble Carrara,	*Brisson.*	2.716
Pyrenean,		2.726
black Biscayan,		2.695
Brocatelle		2.650
Castilian,		2.700
Valencian,		2.710
Grenadian white,		2.705
Siennian,		2.678
Roman violet,		2.755
African,		2.708
Italian, violet,		2.858
Norwegian,		2.728
Siberian,		2.728
French,		2.649

Of Specific Gravities.

		Spec. Grav.
Marble, Switzerland,		2.714
Egyptian, green,		2.668
yellow, of Florence,		2.516
Marmolite,		2.470
Mastic,		1.0742
tree,	*Muschenbroek.*	0.8490
Medlar tree,	*Muschenbroek.*	0.9440
Meerschaum. See *Kessekil.*		
Meionite,		3.10
Melanite, or black garnet,	*Karsten.*	3.691
	Werner.	3.800
Menachanite,	*Lampadius.*	4.270
	Gregor.	4.227
Mercurial hepatic ore, compact,	*Kirwan.*	7.186 7.352
	Gellert.	7.937
Mercury at 32° of heat,		13.619
at 60°,		13.580
at 62°,	*Faraday.*	13.568
at 212°,		13.375
at 3°.42 centigrade,	*Fischer.*	13.58597
in a solid state, 40° below 0° Fahr.	*Biddle.*	15.612
in a fluid state, 47° above 0,	*Biddle.*	13.545
native,	*Haüy.*	13.5681
corrosive muriate of,		6.49
saturated solution, temp. 42°,	*Watson.*	1.037
natural calx of,		9.230
precipitate, *per se*,		10.871
red,		8.399
mineralized by sulphur, native Ethiops. See also *Cinnabar.*	*Hahn.*	2.233
Mesotype,		2.0833
Mica, biaxal,		2.883
	Haüy.	2.6546 2.9342
Milk, woman's,		1.0203
mare's,		1.0346
ass's,		1.0355
goat's,		1.0341
ewe's,		1.0409
cow's,		1.0324
Mineral pitch, elastic, or asphaltum,	*Hatchet.*	0.905 1.233
	La Métherie.	0.930
tallow,		0.770
Molybdate of lead,		6.70
Molybdena in a metallic state, saturated with water,		7.500
native,	*Kirwan.*	4.048
	Schumacher.	4.667
	Brisson.	4.7385
Mountain Crystal. See *Rock-Crystal.*		
Mulberry tree, Spanish	*Muschenbroek.*	0.8970
Muriacite. See *Anhydrite.*		
Muricalcite, crystallized, or rhomb spar,		2.480
Myrrh,		1.3600
N		
Natrolite Swedish,	*Thomson.*	2.779 2.790
red crystals,		2.168
Naphtha, liquid,		0.8475
Naphthaline,		0.65
Nepheline, or Sommite,	*Haüy.*	3.2741
Nephrite. See *Jade.*		
Nickel in a metallic state,		7.421 8.500
	Bergmann.	9.3333
copper,	*Brisson.*	6.6086 6.6481
Nickel copper,	*Gellert.*	7.560
Nickel, ore of, called arsenical nickel, or Kupfernickel of Saxony,		6.648
Kupfernickel of Bohemia,		6.607
sulphuretted,		6.620
forged,	*Richter.*	8.60
and antimony, sulphuret of,		6.451
Nickeline, a metal discovered by Richter, cast,	*Richter.*	8.55
Nigrine, or calcareo-siliceous titanic ore,	*Vauquelin.*	3.700
	Klaproth.	4.445
	Lowitz.	4.673
Nitre,	*Muschenbroek.*	1.9000
crystallized,	*Ure.*	2.0060
quadrangular,	*Muschenbroek.*	2.2460
saturated solution of, temperature 42°,	*Watson.*	1.095
Novaculite, or Turkey hone. See *Slate Whet.*		
O		
Oak, 60 years old, heart of,	*Muschenbroek.*	1.1700
Obsidian,		2.348
Octohedrite,	*Haüy.*	3.857
Oil of filberts,		0.916
walnut,		0.92[illegible]
hemp-seed,		0.9258
poppies,		0.9238
rape-seed,		0.9193
lint-seed,		0.9403
poppy-seed,		0.929
whale,		0.9233
ben, a tree in Arabia,		0.9119
beechmast,		0.9176
codfish,		0.9233
olives,		0.9153
almonds, sweet,		0.9170
volatile of mint, common,		0.8982
sage,		0.9016
thyme,		0.9023
rosemary,		0.9057
calamint,		0.9116
cochlearia,		0.9427
wormwood,		0.9073
tansy,		0.9328
Stragan,		0.9949
Roman camomile,		0.8943
sabine,		0.9294
fennel,		0.9294
fennel-seed,		1.0083
coriander-seed,		0.8655
caraway-seed,		0.9049
dill-seed,		0.9128
anise-seed,		0.9867
juniper-seed,		0.8577
cloves,		1.0363
cinnamon,		1.0439
turpentine,		0.8697
amber,		0.8865
the flowers of orange,		0.8798
lavender,		0.8938
hyssop,		0.8892
Olibanum gum,		1.1732
Olive tree,	*Muschenbroek.*	0.9072
copper ore, foliated,	*Bournon.*	4.281
fibrous	*Bournon.*	4.281
Olivine. See *Peridot.*		
Opal, precious	*Blumenbach.*	2.114
common,	*Klaproth.*	1.958 2.015

Of Specific Gravities.

		Spec. Grav.
Opal, common,	*Kirwan.*	2.144
semiopal reddish, from Telkobanya,	*Klaproth.*	2.540
ligniform, or wood,		2.600
Opium,		13.365
Ophites. See *Porphyry Hornblende.*		
Opoponax,		1.6226
Orange tree,	*Muschenbroek.*	0.7059
Orpiment,	*Kirwan.*	3.048 / 3.435
Orpiment, red. See *Realgar.*		
Osmium and Iridium, alloy of,		19.5
P.		
Palladium,	*Wollaston.*	11.8
	Lowry.	12.14
Paranthine. See *Scapolite.*		
Pear-tree,	*Muschenbroek.*	0.6610
Pearl-stone,		2.34
Pearls, oriental,		2.683
Peat, hard,		1.329
Edinburgh,	*Thomson.*	0.600
Peridot, or Olivine,		3.428
	Werner.	3.225
Peruvian bark,		0.7849
Petalite,		2.440
Petroleum,		0.8783
Petrosilex. See *Hornstone.*		
Pharmacolite, or Arseniate of Lime,		2.640
Phosphorite, or Spargel stone, whitish, from Spain, before absorbing water,		2.8249
after absorbing water,		2.8648
greenish, from Spain,		3.098
Saxon,		3.218
Phosphorus,		1.770
Pierre de volvic,		2.320
Pinite,	*Kirwan.*	2.980
Pitch ore, or sulphuretted uranite,	*Guyton.*	6.378
	Haüy	6.530
	Klaproth.	7.500
Pitch-stone, black,	*Brisson.*	2.0499
yellow,	*Brisson.*	2.0860
red,	*Brisson.*	2.6695
brick red, from Misnia,	*Kirwan.*	2.720
leek green, inclining to olive,	*Kirwan.*	2.298
pearl gray,	*Kirwan.*	1.970
blackish,	*Brisson.*	2.3191
olive,	*Brisson.*	2.3145
dark green,	*Brisson.*	2.3149
Pitchy iron-ore,		3.956
Plasma,		2.04
Platina,	*Klaproth.*	20.722
drawn into wire,		21.0417
a wedge of, sent by Admiral Gravina to Mr Kirwan,		20.663
a bar of, sent by the King of Spain to the King of Poland,		20.722
in grains, purified by boiling in nitrous acid,		17.500 / 18.500
native,		15.601 / 17.200
fused,		14.626
purified and forged,		20.336
milled and purified,	*Haüy*	20.98
compressed by a flatting mill,		22.069
Pleonaste. See *Ceylanite.*		
Plum tree,	*Muschenbroek.*	0.7850
Plumbago, or graphite,	*Kirwan.*	1.987 / 2.267

		Spec. Grav.
Polymignite,		4.806
Pomegranate tree,	*Muschenbroek.*	1.3540
Poplar wood,	*Muschenbroek.*	0.3830
white Spanish,	*Muschenbroek.*	0.5294
Porcelain from China,		2.3847
Seves, hard,		2.1457
tender,		2.1654
Saxony, modern,		2.4932
Limoges,		2.341
of Vienna,		2.5121
Saxony, called *Petite Jaune,*		2.5450
Porcellanite,		2.30
Porphyry, green,		2.6760
red,		2.7651
red of Dauphiny,		2.7933
red from Cordova,		2.7542
green from ditto,		2.7278
hornblende, or orphites,		2.9722
Pitch-stone,		2.452
mullen,		2.600 / 2.728
sand-stone,		2.564
Potash, carbonate of,		1.4594
bicarbonate of,	*Ure.*	2.1532
fused subcarbonate of,	*Ure.*	2.3231
muriate of,	*Muschenbroek.*	1.8365
tartrate of, acidulous,	*Muschenbroek.*	1.9000
antimonial,		2.2460
sulphate of,		2.2980
Potassium at 15° centigrade,	*Gay Lussac* and *Thenard.*	0.97223
Potstone,		2.80 / 3.00
Prasium,		2.5805
Prehnite of the Cape,	*Haüy.*	2.697
	Brisson.	2.9423
of France,	*Haüy.*	2.610
Proof spirit, according to the English excise laws,		0.916
Pumice-stone,		0.9145
Pycnite, or shorlous beryl,	*Haüy.*	3.5145
Pyrallolite,		2.57
Pyrites. See *Copper* and *Iron.*		
Pyrope,	*Klaproth.*	3.718
Pyrochlore,		4.21
	Werner.	3.941
Pyrophysalite,		3.450
Pyrorthite,	*Berzelius.*	2.19
Pyroxene. See *Augite.*		
Q		
Quartz, crystallized, brown, red,		2.6468
brittle,		2.6404
crystallized,		2.6546
milky,		2.652
elastic,	*Gerhard.*	3.750
	Kirwan.	2.6240
Quince tree,	*Muschenbroek.*	0.7050
R		
Realgar, or red orpiment,	*Bergman.*	3.225
	Brisson.	3.338
Resin, or Guiacum,		1.2289
of jalap,		1.2185
Retinasphalt,		0.97 to 1.135
Rhætizite,		3.552
Rhodium,		11.00
Rock-crystal, from Madagascar,		2.6530
clove brown,	*Karsten.*	2.605
snow white from Marmerosch,	*Karsten.*	2.888
crystal, European, pure, gelatinous,		2.6548

Of Specific Gravities.

		Spec. Grav.
Rock-crystal,	*Malus.*	2.63717
of Brazil,		2.6526
iridescent,		2.6497
rose-coloured,		2.6701
yellow Bohemian,		2.6542
blue,		2.5818
violet, or amethyst,		2.6535
violet purple, or Carthaginian amethyst,		2.6570
pale violet, white amethyst,		2.6513
brown,		2.6534
black,		2.6536
Romanzovite,		3.6096
Roucou,		0.5956
penetrated with water,		1.1450
Ruby, oriental,		4.2833
Brazilian, or occidental,		3.5311
spinelle,		3.7600
	Klaproth.	3.5700
ballas,		3.6458
Rutile. See *Titanite.*	*Haüy.*	4.102
	La Métherie.	4.246
Rutilite or Sphene,		3.1 / 3.5
S		
Sahlite,	*Dundrada.*	3.234
Sal gem,		2.143
Salt of vitriol,		1.9000
sedative of Homberg,		1.4797
polychrest,		2.1410
de Prunelle,		2.1480
volatile of hartshorn,		1.4760
Sandarac,		1.0920
Santal, white,	*Muschenbroek.*	1.0410
yellow,	*Muschenbroek.*	0.8090
red,	*Muschenbroek.*	1.1280
Sapagenum,		1.2008
Sappare. See *Cyanite.*		
Sapphire, oriental, white,		3.991
of Puys,		4.076
oriental,		3.994
Brazilian, or occidental,		3.1307
	Haüy.	3.994 / 4.283
	Hatchet. / *Greville.*	4.000 / 4.083
Sarcocolla,		1.2684
Sardonyx, pure,	*Brisson.*	2.6025
pale,	*Brisson.*	2.6060
pointed,	*Brisson.*	2.6215
veined.	*Brisson.*	2.5951
onyx,	*Brisson.*	2.5949
arborescent,	*Brisson.*	2.5988
blackish,	*Brisson.*	2.6284
Sassafras,	*Muschenbroek.*	0.4820
Saussurite,		3.2566 / 3.342
Scammony, of Aleppo,		1.2354
Smyrna,		1.2743
Scapolite, or Paranthine,	*Dandrada.*	3.6800 / 3.7000
Schistus. See *Slate, Hone, Stone,*		
Schmelstein. See *Dipyre.*		
Schorl, black, prismatic, hexahedral,		3.3636
octahedral,		3.2265
enneahedral,		3.0926
black, sparry,		3.3852
amorphous, or ancient basaltes,		2.9225

Of Specific Gravities.

		Spec. Grav.
Schorl, cruciform,		3.2861
violet of Dauphiny,		3.2956
green,		3.4529
common,	*Brisson.*	3.092
	Gerhard.	3.150
	Kirwan.	3.212
Selenite, or broad foliated gypsum,		2.322
Serpentine, opaque, green, Italian,		2.4295
penetrated with water,		2.4729
ditto, red and black veined,		2.6273
ditto, veined, black and olive,		2.5939
semitransparent, grained,		2.5859
ditto, fibrous,		2.9997
ditto, from Dauphiny,		2.6693
opaque, spotted black and white,		2.3767
spotted black and grey,		2.2645
spotted red and yellow,		2.6885
green from Grenada,		2.6849
deep green from Grenada,		2.7097
black, from Dauphiny, or variolite,		2.9339
green from Dauphiny,		2.9883
green,		2.8960
yellow,		2.7305
violet,		2.6424
of Dauphiny,		2.7913
Shale,		2.6
Siderocalcite, or brown spar,		2.837
Sidero-schisolite,		3.00
Silver, sulphuretted, or silver-glance,	*Brisson.*	6.910
	La Métherie.	7.200
brittle,	*Gellert.*	7.208
white,		5.3
red, or ruby,	*Brisson.*	5.564
light red,	*Brisson.*	5.5886
	Gellert.	5.443
sooty,	*Vauquelin.*	5.592
native, common,	*Gellert.*	10.000
	Selb.	10.333
antimonial,	*Haüy.*	9.4406
	Selb.	10.000
auriferous,	*Kirwan.*	10.600
ore, dark red,	*Gellert.*	5.684
	Brisson.	5.5637
arseniated, ferruginous,		2.178
penetrated with water,		2.340
ore, corneous, or horn ore,	*Brisson.*	4.7488
	Gellert.	4.804
virgin, 12 denier, fine, not hammered,		10.474
12 deniers, hammered,		10.510
Paris standard, 11 deniers, 10 grains, fused,		10.175
hammered,		10.376
	Klaproth.	10.784
shilling of George II.		10.000
George III.		10.534
French money, 10 deniers, 21 grains, fused,		10.048
French money, 10 deniers, 21 grains, coined,		10.408
Sinople, coarse jasper,		2.6913
Slate clay. See *Argillite.*		
common,		2.6718
or schistus, common,		2.6718
penetrated with water,		2.6905
whet, or novaculite,	*Kirwan.*	0.722 / 2.609
Isabella yellow,	*Kirwan.*	2.955
stone,		2.1861
fresh polished,		2.7664

Of Specific Gravities.

		Spec. Grav
Slate adhesive,	*Klaproth.*	2.080
new,		2.8535
siliceous,	*Kirwan.*	2.596 2.641
horn, or schistose porphyry,	*Kirwan.*	2.512 2.700
Smalt, or blue glass of cobalt,		2.440
Smaragdite, from Corsica,		3.000
Soda, sulphate of,	*Ure.*	1.4398
muriate of,	*Ure.*	2.0058
saturated solution, temperature 42°,	*Watson.*	1.198
nitrate of,		2.09
carbonate of,		1.0 to 1.5
sesquicarbonate of,		2.11
tartrate of, saturated solution of,	*Watson.*	1.114
fossil,		2.1430
saturated solution of, temperature 42°,	*Watson.*	2.054
Sodalite,		2.294
Sodium, at 15° centigrade,	*Gay-Lussac* and *Thénard.*	0.86507
Sommite. See *Nepheline.*		
Sordawalite,		2.530
Spar, brown. See *Sidero-Calcite.*		
white sparkling,		2.5946
red ditto,		2.4378
green ditto,		2.7045
blue ditto,		2.6925
green and white ditto,		3.1051
transparent ditto,		2.5644
adamantine. See *Corundum.*		3.873
schiller. See *Hornblende Labrador.*		
fluor, white,		3.1555
red, or false ruby,		3.1911
octahedral,		3.1815
yellow, or false topaz,		3.0967
green, or false emerald,		3.1817
octahedral,		3.1838
blue, or false sapphire,		3.1688
greenish blue, or false aquamarine,		3.1820
violet, or false amethyst,		3.1757
violet purple,		3.1857
English,		3.1796
of Auvergne,		3.0943
in stalactites,		3.1668
pearl, or bitter (carb. of lime and magnesia),		2.8378
calcareous rhomboidal,		2.7151
in tubes,		2.71409
of France,		2.7146
prismatic,		2.7182
and pyramidal,		2.7115
pyramidal,		2.7141
(puant gris),		2.7121
(puant noir),		2.6207
or flos ferri,		2.6747
Spargel stone. See *Phosphorite.*		
Spermaceti,		0.9433
Spinelle. See *Ruby.*		
Sphene. See *Rutilite.*		
Spirit of wine. See *Alcohol.*		
Spodumene, or triphane,	*Haüy.*	3.1923
	Dandrada.	3.218
Stalactite transparent,		2.3239
opaque,		2.4783
penetrated with water,		2.5462
Staurotide, staurolite, or grenatite,	*Haüy.*	3.286
Steatites of Bareight,		2.6149
penetrated with water,		2.6757
indurated,		2.5834

		Spec. Grav.
Steatites of Bareight, penetrated with water,		2.6322
Steel,	*Muschenbroek.*	7.767
soft,		7.8331
hammered,		7.8404
hardened in water,		7.8163
hammered, and then hardened in water,		7.8180
Sternbergite,		4.215
Stilbite,		2.50
Stilpno-siderite,		3.611
St John's wort, inspissated juice of,		1.5263
Strontian, sulphate of,	*Haüy.*	3.583 3.958
carbonate of,	*Haüy.*	3.658 3.675
Stone, sand, paving,		2.4158
grinding,		2.1429
cutler's,		2.1113
Fountainbleau, glittering,		2.5616
crystallized,		2.6111
scythe of Auvergne, mean grained,		2.5638
fine grained,		2.6090
coarse grained,		2.5686
Lorraine,		2.5298
Liege,		2.6356
mill,		2.4835
Bristol,		2.510
Burford,		2.049
Portland,		2.496
rag,		2.470
rotten,		1.981
St Cloud,		2.201
St Maur,		2.034
Nôtre Dame,		2.378
clicard from Brachet,		2.357
rock of Châtillon,		2.122
hard paving,		2.460
Siberian blue,		2.945
touch,		2.415
prismatic basaltes,		2.722
of the quarry of Bourè,		1.3864
of Cherence,		2.4682
Storax,		1.1098
Stromnite,		3.703
Sugar, white,	*Muschenbroek.*	1.6060
Sulphur, native,	*Haüy.*	2.0332
fused,		1.9907
chloride of,		1.6
Sulphuric, or vitriolic acid,		1.841
Sulphuret, triple, of lead, antimony, and copper,	*Hatchet.*	5.766
silver of copper,		6.255
Sylvanite, or tellurite, in a metallic state, twice fused,		6.343
Sylvan, native,	*Jacquin jun.*	4.107
	Maller.	5.723
	Klaproth.	6.115
ore, yellow,	*Muller.*	10.678
black,	*Jacquin jun.*	6.157
	Muller.	8.919
Syringa,	*Muschenbroek.*	1.0989

T

Tabasheer,	*Jardine.*	2.059 2.412
Tacamahaca, resin,		1.0463
	Haüy.	2.8534 2.8729
Tachylite,		2.52
Talc, black crayon,		2.080
ditto German,		2.246

Of Specific Gravities.

		Spec. Grav.
Talc, yellow,		2.655
white,		2.704
of mercury,		2.7917
black,		2.9004
earthy,		2.6325
slaty,	*Gahn* and *Berzelius.*	2.718
common Venetian,		2.700 2.800
indurated,		2.90
Tallow,		0.9419
Tantalite,	*Ekeberg.*	7.953
Tantalium metal,	*Berzelius.*	5.61
in large masses,	*Gahn* and *Berzelius.*	6.291
in small pieces,		6.208
Tartar,	*Muschenbroek.*	1.8490
Telesie. See *Sapphire.*		
Terra Japonica,		1.3980
Tellurium, native,		5.700 6.10
graphic,		5.7
yellow, of Naygag,		10.67
black,		8.9
Tennantite,		4.375
Thenardite,		2.73
Thomsonite,		2.35 to 2.4
Tin, pure, from Cornwall, fused,	*Watson.*	7.170 7.291
fused and hammered,		7.291
of Malacca, fused,		7.296
fused and hammered,		7.306
of Gallicia,	*Gellert.*	7.063
of Ehrenfriedensdorf in Saxony,	*Gellert.*	7.271
pyrites,	*Klaproth.*	4.350
	La Metherie.	4.785
stone,	*Gellert.*	6.300 6.989
	Brunich.	6.750
black,	*Brisson.*	6.901
red,	*Brisson.*	6.9348
	Klaproth.	5.845 6.970
fibrous,	*Werner.*	7.000
	Brunich.	5.800
	Blumenbach.	6.450
new, fused,		7.3013
fused and hammered,		7.3115
fine, fused,		7.4789
fused and hammered,		7.5194
common,		7.9200
called *Claire-etoffe*,		8.4869
ore, Cornish,	*Brunich.*	5.800
	Klaproth.	6.450
from Fahlun,	*Gahn* and *Berzelius.*	6.55
stone, white,		6.008
Titanite, Rutilite, or Sphene,	*Haüy.*	4.102
	La Métherie.	4.246
Topaz, oriental,		4.0106
Brazilian,		3.5365
from Saxony,		3.5640
oriental pistachio,		4.0615
Saxony white,		3.5535
greenish blue,	*Haüy.*	3.5489
red,	*Haüy.*	3.5311
Tourmaline,	*Brisson.*	3.086
green,	*Haüy.*	3.362
blue,	*Werner.*	3.155
Tremolite,		2.931
Triclasite,		2.61 to 2.66
Torrelite,		3.25
Triphane. See *Spodumene.*		

		Spec. Grav.
Tungstate of lead,		8.1
Tungsten,	*Leysser.*	4.355
	Kirwan.	5.800 6.028
	Brisson.	6.066 6.015
	Klaproth.	5.570
Turbeth mineral,		8.235
Turpentine, spirits of,		0.870
liquid,		0.991
Turquoise, ivory tinged by the blue calx of copper,		2.500 2.908
oriental, or calaite,		2.83 to 3.0
U		
Ultramarine,	*Desormes* and *Clement.*	2.360
Uran glimmer, or Uranite,		2.19
Uranite in a metallic state,	*Klaproth.*	6.440
sulphuretted. See *Pitch ore.*		
Uranitic ochre indurated,	*La Métherie.*	3.150
	Haüy.	3.2438
Uranium,		7.500
sulphate of,		3.19
Urine, human,		1.015 1.026
diabetic,	*Henry.*	1.028 1.040
V		
Vanadiate of lead,		6.99 to 7.23
Vauquelinite,		5.5 to 5.78
Vermeille, a kind of oriental ruby,		4.2299
Vesuvian,	*Wiedemann.*	3.575
	Klaproth.	3.420
of Siberia,	*Klaproth.*	3.365 3.339
	Hauy.	3.407
Vine,	*Muschenbroek.*	1.2370
Vinegar, red,	*Muschenbroek.*	1.0251
white,		1.0135
radical,		1.080
Vitriol, Dantzic,		1.715
W		
Walnut-tree of France,	*Muschenbroek.*	0.6710
Wagnerte,	*Fuchs.*	3.11
	Levy.	3.01
Water distilled at 32° of Fahr.		1.0000
sea,		1.0263
of Dead Sea,		1.2403
	Gay-Lussac.	1.2283
wells,		1.0017
of Bareges,		1.00037
of the Seine filtered,		1.00015
of Spa,		1.0009
of Armeil,		1.00046
Avray,		1.00043
Seltzer,		1.0305
Wavellite, or hydrargillite, from Barnstaple,		2.337
Wax, bees,		0.9648
white,		0.9686
shoemakers,		0.897
Whey, cows,		1.019
Willow,	*Muschenbroek.*	0.5850
Wine of Torrins, red,		0.9930
white,		0.9876
Champagne, white,		0.9979
Pakarete,		0.9997
Xeres,		0.9924
Malmsey Madeira,		1.0382

Of Specific Gravities.

		Spec. Grav.
Wine of Burgundy,		0.9915
Jurançon,		0.9932
Bourdeaux,		0.9939
Malaga,		1.0221
Constance,		1.0819
Tokay,		1.0538
Canary,		1.033
Port,		0.997
Withamite,		3.137
Witherite. See *Barolite*.		
Wodanium metal,	*Lampadius.*	11.470
pyrites,	*Lampadius.*	5.192
Wolfram,	*Gmelin.*	5.705
	Elhuyar.	6.835
	Leonhardi.	7.000
	Hatchet.	6.955
	Haüy.	7.333
Wolf's eye (name of a mineral),		2.3507
Woodstone,		2.045 / 2.675
Y		
Yenite. See *Jenite*.		
Yew tree, Dutch,	*Muschenbroek.*	0.7880
Spanish,	*Muschenbroek.*	0.8070
Yttria, phosphate of,	*Berzelius.*	4.558
Yttrotantalite, black,	*Berzelius.*	5.395
Yttrotantalite, yellow,		5.882
Yttrocerite,	*Gahn* and *Berzelius.*	3.447
Z		
Zeolite from Edelfors, red, scintillant,		2.4868
white scintillant,		2.0739
compact,		2.1344
cubic. See *Chabasie*.		
siliceous,		2.515
Zinc, pure and compressed,		7.1908
in its usual state,	*Bergman.*	6.862
formed by sublimation and full of cavities,	*Kirwan.*	5.918
sulphate of,	*Muschenbroek.*	1.900 to 2.00
saturated solution of, temp. 42°,	*Watson.*	1.386
green, oxide of,		4.924
See *Blende*.		
Zinkenite,		5.306
Zircon, or Jargon,	*Klaproth.*	4.615
	Karsten.	4.666
	Wiedemann.	4.700
	Haüy.	4.3858 / 4.4161
Zirconia,		4.3
Zirconite,		4.24
Zoisite,	*Klaproth.*	3.26 / 3.31
Zurlite,		3.274

CHAPTER III.—ON CAPILLARY ATTRACTION, AND THE COHESION OF FLUIDS.

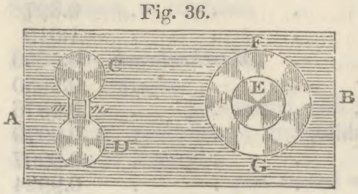
Fluids do not rise to the same level in a system of communicating vessels when their diameters are very minute.

128. We have already seen, when discussing the equilibrium of fluids, that when water or any other fluid is poured into a vessel, or any number of communicating vessels, its surface will be horizontal, or it will rise to the same height in each vessel, whatever be its form or position. This proposition, however, only holds true when the diameter of these vessels or tubes exceeds the fifteenth of an inch: for if a system of communicating vessels be composed of tubes of various diameters, the fluid will rise to a level surface in all the tubes which exceed one fifteenth of an inch in diameter; but in the tubes of a smaller bore, it will rise above that level to altitudes inversely proportional to the diameters of the tubes. The power by which the fluid is raised above its natural level is called *capillary attraction*, and the glass tubes which are employed to exhibit its phenomena are named *capillary tubes*. These appellations derive their origin from the Latin word *capillus*, signifying a hair, either because the bores of these tubes have the fineness of a hair, or because that substance is itself supposed to be of a tubular structure.

There is an attraction of cohesion between glass and water, and between the particles of water.

129. When we bring a piece of clean glass in contact with water or any other fluid, except mercury and fused metals, and withdraw it gently from its surface, a portion of the fluid will not only adhere to the glass, but a small force is necessary to detach this glass from the fluid mass, which seems to resist any separation of its parts. Hence it is obvious that there is an attraction of cohesion between glass and water, and that the constituent particles of water have also an attraction for each other. The suspension of a drop of water from the lower side of a plate of glass is a more palpable illustration of the first of these truths; and the following experiment will completely verify the second. Place two large drops of water on a smooth metallic surface, their distance being about the tenth of an inch. With the point of a pin unite these drops by two parallel canals, and the drops will instantly rush to each other through these canals, and fill the dry space that intervenes. This experiment is exhibited in fig. 36, where AB is the metallic plate, C, D the drops of water, and m, n, the two canals.

Fig. 36.



Attempt to account for the rise of water in capillary tubes. Fig. 36.

130. Upon these principles many attempts have been made to account for the elevation of water in capillary tubes; but most of the explanations which have hitherto been offered, are founded upon hypothesis, and are very far from being satisfactory. Without presuming to substitute a better explanation in the room of those which have been already given, and so frequently repeated, we shall endeavour to illustrate that explanation of the phenomena of capillary attraction which seems liable to the fewest objections. For this purpose let E be a drop of water laid upon a clean glass surface AB. Every particle of the glass immediately below the drop E, exerts an attractive force upon the particles of water. This force will produce the same effect upon the drop as a pressure in the opposite direction, the pressure of a column of air, for instance, on the upper surface of the drop. The effect of the attractive force, therefore, tending to press the drop to the glass will be an enlargement of its size, and the water will occupy the space FG; this increase of its dimensions will take place when the surface AB is held downwards; and that it does not arise from atmospheric pressure may be shewn by performing the experiment *in vacuo*. Now, let A B (fig. 37.) be a section of the plate of glass, AB (fig. 36.) held vertically, part of the water will descend by its gravity, and form a drop B, while a small film of the fluid will be supported at m by the attraction of the glass. Bring a similar plate of glass CD, into a position parallel to AB, and make them approach

Fig. 37.

apillary traction, &c.

nearer and nearer each other. When the drops B and D come in contact, they will rush together from their mutual attraction, and will fill the space $o\ p$. The gravity of the drops B and D being thus diminished, the films of water at m and n, which were prevented from rising by their gravity, will move upwards. As the plates of glass continue to approximate, the space between them will fill with water, and the films at m and n being no longer prevented from yielding to the action of the glass immediately below them, (by the gravity of the water at $o\ p$, which is diminished by the mutual action of the fluid particles) will rise higher in proportion to the approach of the plates. Hence it may be easily understood how the water rises in capillary tubes, and how its altitude is inversely as their internal diameters. For let A, a be the altitudes of the fluid in two tubes of different diameters D, d; and let C, c be the two cylinders of fluid which are raised by virtue of the attraction of the glass. Now, as the force which raises the fluid must be as the number of attracting particles, that is, as the surface of the tube in contact with the water, that is, as the diameter of the tubes, and as this same force must be proportional to its effects on the cylinder of water raised, we shall have $D : d = C : c$. But (GEOMETRY, Sect. VIII. Theor. XI. Sect. IX. Theor. II.) $C : c = D^2A : d^2a$, therefore $D^2A : d^2a = D : d$; hence $D^2A\ d = d^2a\ D$, and $DA = \frac{d^2aD}{Dd}$, or $DA = da$, that is, $D : d = a : A$, or the altitudes of the water are inversely as the diameters of the tubes. Since $DA = da$, the product of the diameter by the altitude of the water will always be a constant quantity. In a tube whose diameter is 0.01, or $\frac{1}{100}$ of an inch, the water has been found to reach the altitude of 5.3 inches; hence the constant quantity $5.3 \times 0.1 = 0.053$ may fitly represent the attraction of glass for water. According to the experiments of Muschenbroek, the constant quantity is 0.039; according to Weitbrecht 0.0428; according to Monge 0.042, and according to Atwood 0.0530. When a glass tube was immersed in melted lead, Gellert found the depression multiplied by the bore to be 0.0054.

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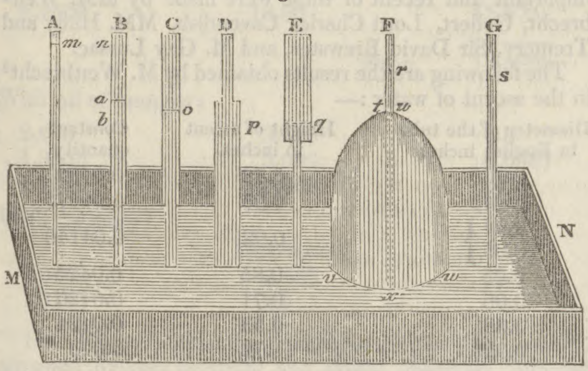
henomena of capillary attraction.

131. Having thus attempted to explain the causes of capillary action, we shall now proceed to consider some of its more interesting phenomena. In fig. 38. MN is a vessel of water in which tubes of various forms are immersed. The water will rise in the tubes A, B, C, to different altitudes m, n, o, inversely proportional to their diameters. If the tube B is broken at a, the water will not rise to the very top of it at a, but will stand at b, a little below the top, whatever be the length of the tube, or the diameter of its bore. If the tube be taken from the fluid and laid in a horizontal position, the water will recede from the end that was immersed. These two facts seem to countenance the opinion of Dr Jurin[1] and other philosophers, that the water is elevated in the tube by the attraction of the annulus, or ring of glass, *immediately above* the cylinder of water. This hypothesis is sufficiently plausible; but supposing it to be true, the ring of glass immediately below the surface of the cylinder of fluid should produce an equal and opposite effect, and therefore the water instead of rising should be stationary, being influenced by two forces of an equal and opposite kind.

Fig. 38.



Jurin's hypothesis.

Phenomena of capillary attraction.

132. If a tube D composed of two cylindrical tubes of different bores be immersed in water with the widest part downwards, the water will rise to the altitude p, and if another tube E of the same size and form be plunged in the fluid with the smaller end downwards, the water will rise to the same height q as it did in the tube D. This experiment seems to be a complete refutation of the opinion of Dr Jurin, that the water is raised by the action of the annulus of glass above the fluid column; for since the annular surface is the same at q as at p, the same quantity of fluid ought to be supported in both tubes, whereas the tube E evidently raises much less water than D. But if we admit the supposition in art. 130, that the fluid is suported by the whole surface of glass in contact with the water, the phenomenon receives a complete explanation; for since the surface of glass in contact with the fluid in the tube E is much less than the surface in contact with it in the tube D, the quantity of fluid sustained in the former ought to be much less than the quantity supported in the latter.

Phenomena of capillary attraction. Fig. 38.

133. When a vessel F vw, fig. 38. is plunged in water, and the lower part $tuvw$ filled by suction till the fluid enter the part F t, the water will rise to the same height as it does in the capillary tube G, whose bore is equal to the bore of the part F t. In this experiment the portions of water tvx and uxw on each side of the column F x are supported by the pressure of the atmosphere on the surface of the water in the vessel MN; for if this vessel be placed in the exhausted receiver of an air-pump, these portions of water will not be sustained. Dr Jurin, indeed, maintains that these portions will retain their position *in vacuo*, but in his time the exhausting power of the air-pump was not sufficiently great to determine a point of so great nicety. The column tux, which is not sustained by atmospherical pressure, is kept in its position by the attraction of the water immediately around and above it, and the column F tu is supported by the attraction of the glass surface with which it is in contact. According to Dr Jurin's hypothesis, the column tux is supported by the ring of glass immediately above r, which is a very unlikely supposition.

Hypothesis of Dr Hamilton and Dr Matthew Young.

134. The preceding experiment completely overturns the hypothesis of Dr Hamilton, afterwards revived by Dr Matthew Young. These philosophers maintained that the fluid was sustained in the tube by the lower ring of glass contiguous to the bottom of the tube, that this ring raises the portion of water immediately below it, and then other portions successively till the portion of water thus raised be in equilibrium with the attraction of the annulus in question. But if the elevation of the fluid were produced in this way, the quantity supported would be regulated by the form and magnitude of the orifice at the bottom of the tube; whereas it is evident from every experiment, that the cylinder of fluid sustained in capillary tubes has no reference whatever to the form of the lower annulus, but depends solely upon the diameter of the tube immediately above the elevated column of water.

These phenomena occur in an exhausted receiver.

135. If the experiments which we have now explained be performed in the exhausted receiver of an air-pump, the water will rise to the same height as when they are

[1] *Philosophical Transactions*, No. 363, Art. 2.

performed in air. We may therefore conclude, that the ascent of the water is not occasioned, as some have imagined, by the pressure of the atmosphere acting more freely upon the surface of the water in the vessel than upon the column of fluid in the capillary tube.

Experiments of M. Louis Carré on the ascent of different fluids in capillary tubes.

136. Numerous experiments have been made on the ascent of water and other fluids in capillary tubes. Among the earliest of these we may enumerate the experiments of M. Louis Carré, which were made previous to 1705. He found that in a tube *twelve* inches long water rose 10 lines, when the diameter of the tube was $\frac{1}{3}$ of a line, 18 lines when its diameter was $\frac{1}{6}$, and 30 lines when its diameter was $\frac{1}{10}$ of a line.

The following are the results which he obtained with different fluids, and with a glass tube *twelve* inches in length:

Names of Fluids.	Diameter of the glass tube in parts of a line.	Height of ascent in lines.
Water,	$\frac{1}{3}$ of a line.	10
Alcohol,		$3\frac{1}{2}$
Spirits of turpentine,		4
Oil of tartar,		5
Spirit of nitre,		4
Oil of olives,		5
Tube 9 Inches long.		
Water,	$\frac{1}{3}$ of a line.	10
Alcohol,		4
Tube 15 Inches long.		
Water,	$\frac{1}{6}$ of a line.	29
Alcohol,		12
Tube 5 Inches long.		
Water,	$\frac{1}{6}$ of a line.	27
Alcohol,		12 nearly.

Experiments of Mr B. Martin

137. The following experiments were made by Mr Benjamin Martin with a tube about $\frac{1}{25}$ of an inch in diameter:[1]

Names of the Fluids.	Height of Ascent in inches.	Constant Number.
Common spring water,	1.2	.048
Spirit of urine,	1.1	.044
Tincture of galls,	1.1	.044
Recent urine,	1.1	.044
Spirit of salt,	0.9	.036
Ol. tart. per deliq.	0.9	.036
Vinegar,	0.95	.038
Small beer,	0.9	.036
Strong spirit of nitre,	0.85	.034
Spirit of hartshorn,	0.85	.034
Cream,	0.8	.032
Skimmed milk,	0.8	.032
Aquafortis,	0.75	.030
Red wine,	0.75	.030
White wine,	0.75	.030
Ale,	0.75	.030
Ol. sul. per campanam,	0.65	.026
Oil of vitriol,	0.65	.026
Sweet oil,	0.6	.024
Oil of turpentine,	0.55	.022
Geneva,	0.55	.022
Rum,	0.5	.020
Brandy,	0.5	.020
White hard varnish,	0.5	.020
Spirit of wine,	0.45	.018
Tincture of mars,	0.45	.018

138. To the preceding table as given by Mr Martin we have added the constant number for each fluid, or the product of the altitude of the liquid, and the diameter of the tube (art. 130). By this number, therefore, we can find the altitude to which any of the preceding fluids will rise in a tube of a given bore, or the diameter of the bore when the altitude of the fluid is known; for since the constant number $C = DA$ (art. 130.) we shall have $D = \frac{C}{A}$ and $A = \frac{C}{D}$. Since the constant number, however, as deduced from the experiments of Martin, may not be perfectly correct, it would be improper to derive from it the diameter of the capillary bore when great accuracy is necessary.

Method of measuring the internal diameter of a capillary tube.

The following method, therefore, may be adopted as the most correct that can be given. Put into the capillary tube a quantity of mercury, whose weight in troy grains is W, and let the length L of the tube which it occupies be accurately ascertained; then if the mercury be pure and at the temperature of 60° of Fahrenheit, the diameter of the tube $D = \sqrt{\frac{W}{L}} \times 0.019241$, the specific gravity of mercury being 13.580. The weight of a cubic inch of mercury being 3438 grains, and the solid contents of the mercurial column being $D^2 L \times 0.7854$, we shall have $1 : 3438 = D^2 L \times 0.7854 : W$. Hence (GEOMETRY, Sect. IV. Theor. VIII.) $D^2 L \times 0.7854 \times 3438 = W$, and dividing we have $D^2 = \frac{W}{L \times 0.7854 \times 3438}$ or $D = \sqrt{\frac{W}{L \times 0.7854 \times 3438}}$ or $D = \sqrt{\frac{W}{L}} \times 0.019241$. If the whole tube be filled with mercury, and if W be the difference in troy grains between its weight when empty, and when filled with mercury, the same theorem will serve for ascertaining the diameter of the tube. Should the temperature of the mercury happen to be 32° of Fahrenheit, its specific gravity will be 13.619, which will alter a very little the constant multiplier 0.019241.

139. Various experiments on the ascent of fluids in capillary tubes have been made by different individuals. The most important and recent of these were made by MM. Weitbrecht, Gellert, Lord Charles Cavendish, MM. Haüy and Tremery, Sir David Brewster, and M. Gay Lussac.

Experiments of Weitbrecht.

The following are the results obtained by M. Weitbrecht[2] in the ascent of water:—

Diameter of the tube in English inches.	Height of ascent in inches.	Constant quantity.
0.065	0.72	0.0432
0.045	0.95	0.04275
0.04 / 0.05	0.92	0.04140
0.05	0.85	0.0425
0.06	0.71	0.0426
0.08	0.53	0.0424
0.025	1.72	0.043
	Mean,	0.04255

Of Gellert.

140. A series of experiments were made in 1740 by M. Gellert, on the descent of melted lead in capillary tubes of glass. For this purpose he used the thinnest tubes, and heating them gradually before immersion in the lead, he obtained the following measures:—

[1] Mr Martin found, that when capillary tubes, containing different fluids, were suspended in the sun for months together, the inclosed fluid was not in the least degree diminished by evaporation.

[2] *Comment. Acad. Petrop.* 1736.

apillary traction, &c.

Diameter of tube.	Descent.	Constant quantity.
0.21 English inch,	0.27 inch,	567
0.07 ...	0.73 ...	510
	Mean, .	5385

M. Gellert likewise made experiments on the ascent of *water* in prismatic tubes, with a triangular and quadrangular bore, made of iron, and he found that they gave results analogous to those obtained with tubes of glass.

xperiments of ord harles avendish.

141. The most accurate experiments on the depression of mercury in capillary tubes are those made by Lord Charles Cavendish:

Interior diameter of tube.	Mercury in one inch of tube.	Depression of the mercury.
0.6 inches.	972 grains.	0.005 inches.
0.5	675	0.007
0.4	432	0.015
0.35	331	0.025
0.30	243	0.036
0.25	169	0.050
0.20	108	0.067
0.15	61	0.092
0.10	27	0.140

The constant quantity deduced by Dr Thomas Young from the preceding experiments is 0.015.

xperiments of r Robin.

142. The following experiments were made by Dr Robison, on the ascent of different fluids in a glass tube of a very slender bore, but its diameter is not mentioned.

	Height of ascent.
Solution of sal ammoniac, .	8.07 inches.
Caustic volutile alkali, . .	6.25
Water, ...	5.5
Spirits of wine, . . .	2.5
Oil of turpentine, . .	1.35

aüy and remery's periments.

143. A series of careful experiments was made by MM. Haüy and Tremery, at the request of La Place, on the ascent of water and oil of oranges in glass tubes; and also on the depression of mercury. The following results were obtained with water:

Diameter of tube.	Height of ascent.	Constant quantity, or height for 1 millimetre.
2.0000 millimetres.	6.75 millimetres.	13.50
1.3333	10.00	13.333
0.7500	18.50	13.875
	Mean,	13.5693

With oil of oranges:

2.000	3.400	6.8
1.3333	5.000	6.6667
0.7500	9.000	6.75

With mercury:

	Depression.
2.0000	3.666
1.3333	5.5

rewster's xperiments on pillary traction.

144. The very great discrepancy in the preceding results, obtained by very accurate and skilful observers, induced Sir David Brewster to repeat the experiments with an instrument constructed for the purpose, and to take such precautions, that he could always obtain the same results after repeated trials. The following description of the instrument which he used, and of the precautions which he adopted, will enable the reader to judge of the accuracy of the results.

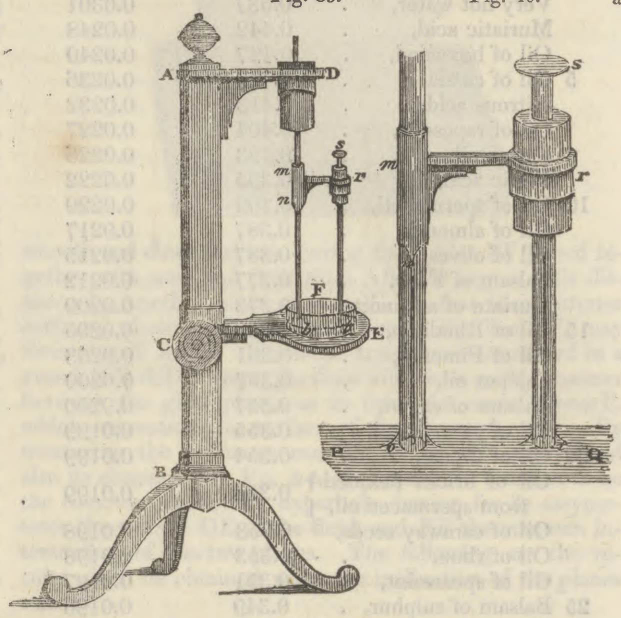
Having obtained a glass tube 7.9 inches long, and of a uniform circular bore, he took a wire of a less diameter than the bore of the tube, and formed a small hook at one of its ends. This hook was fastened to the middle of a worsted thread, of such a size as, when doubled, to fill the bore of the tube. The wire was then passed through the tube, and the worsted thread drawn after it; and when the whole was plunged in an alkaline solution, the worsted thread was fixed at one end, and the tube was drawn backwards and forwards, till it was completely deprived, by its friction on the thread, of any grease or foreign matter which might have adhered to it. The tube and thread were then taken to clean water, and the same operation was repeated.

Capillary Attraction, &c.

Instrument for measuring capillary attraction.

When the tube was thus perfectly cleaned, it was fixed vertically, by means of a level, in the axis of a piece of wood D (fig. 39.), supported by the arm AD, fixed upon

Fig. 39. Fig. 40.



a stand AB; and it was also furnished with an index *mn*, which was moveable to and from the extremity *b*. On the arm CE, moveable in a vertical direction by the nut C, was placed a glass vessel F, containing the fluid, and nearly filled with it. The nut C was then turned till the extremity *b* of the tube touched the surface of the fluid, which was indicated by the sudden rise of the liquor round its sides. The fluid then rose in the tube till it remained stationary, and the index *mn* was moved till its extremity *n* pointed out the exact position of the upper surface of the fluid. In this situation, the distance *nb* was a measure of the ascent of the liquid above its level in the vessel E. In order to ascertain, however, whether the fluid was stationary, in consequence of any obstruction in the tube, or of an equilibrium of the attracting forces, the vessel with the fluid was raised a little higher than its former position, by means of the nut C, and then depressed below it. If the fluid now rose a little above *n*, and afterwards sunk a little below it, so as always to rise and fall with facility and uniformity along with the surface of the fluid in the vessel, it was obvious that it suffered no obstruction in the tube, and that *nb* was the accurate measure of its height. By separating the extremity *b* of the tube from the surface of the fluid, the fluid always rises above *n*; but upon again bringing them into contact, the fluid resumes its position at *n*. If there should be any portion of fluid at the end *b* of the tube, when it is again brought in contact with the fluid surface, the water would rise around it before it had reached the general level, and therefore the height of the fluid obtained measuring from the end of the tube would be too small.by

In order to avoid this source of error, the index should have a projecting arm *mn*, Fig. 40, carrying a screw *st*, whose sharp point *t* can be easily brought on a level with the end *b* of the tube. When the extremity *t*, therefore, which can always be kept dry, comes in contact with the fluid surface PQ, the extremity *b* must also be exactly on the same level, even though the fluid had already risen around it. The tube was then cleaned, as formerly, for a subsequent observation. The results which were thus obtained for a great variety of fluids, and with a tube 0.0561 of an inch in diameter, are given in the following table:—

	Names of Fluids.	Height of Ascent, in inches.	Constant Quantity.
	Water,	0.587	0.0327
	Very hot water,	0.537	0.0301
	Muriatic acid,	0.442	0.0248
	Oil of boxwood,	0.427	0.0240
5	Oil of cassia,	0.420	0.0236
	Nitrous acid,	0.413	0.0232
	Oil of rapeseed,	0.404	0.0227
	Castor oil,	0.403	0.0226
	Nitric acid,	0.395	0.0222
10	Oil of spermaceti,	0.392	0.0220
	Oil of almonds,	0.387	0.0217
	Oil of olives,	0.387	0.0215
	Balsam of Peru,	0.377	0.0212
	Muriate of antimony,	0.373	0.0209
15	Oil of Rhodium,	0.366	0.0205
	Oil of Pimento,	0.361	0.0203
	Cajeput oil,	0.357	0.0200
	Balsum of capivi,	0.357	0.0200
	Oil of pennyroyal,	0.355	0.0199
20	Oil of thyme,	0.354	0.0199
	Oil of bricks distilled from spermaceti oil,	0.354	0.0199
	Oil of caraway seeds,	0.353	0.0198
	Oil of rhue,	0.353	0.0198
	Oil of spearmint,	0.351	0.0197
25	Balsam of sulphur,	0.349	0.0196
	Oil of sweet fennel seeds,	0.349	0.0195
	Oil of hyssop,	0.349	0.0195
	Oil of rosemary,	0.344	0.0193
	Oil of bergamot,	0.343	0.0192
30	Oil of amber,	0.343	0.0192
	Oil of anise seeds,	0.342	0.0192
	Oil of Barbadoes tar,	0.341	0.0191
	Laudanum,	0.340	0.0191
	Oil of cloves,	0.334	0.0187
35	Oil of turpentine,	0.333	0.0187
	Oil of lemon,	0.333	0.0187
	Oil of lavender,	0.328	0.0184
	Oil of camomile,	0.327	0.0184
	Oil of peppermint,	0.327	0.0184
40	Oil of sassafras,	0.327	0.0184
	Highland whisky,	0.327	0.0184
	Brandy,	0.326	0.0183
	Oil of wormwood,	0.326	0.0183
	Oil of dill seed,	0.324	0.0182
45	Oil of ambergrease,	0.323	0.0181
	Genuine oil of juniper,	0.321	0.0180
	Oil of nutmeg,	0.320	0.0180
	Alcohol,[1]	0.317	0.0178
	Oil of savine,	0.310	0.0174
50	Æther,	0.285	0.0160
	Oil of wine,	0.273	0.0153
	Sulphuric acid,	0.200	0.0112

Gay Lussac's experiments.

145. By means of an instrument similar in principle to the one above described,[2] M. Gay Lussac made a series of accurate experiments on the ascent of water and alcohol in capillary tubes. In these experiments the tubes were well wetted with the fluid.

Experiments with Water.

Diameter of the tube.	Height of ascent above lowest point of concavity.	Temp. of fluid. Centigrade.
1.29441 millim.	23.3164 millim.	
1.90381	15.5861	8°.5

The constant quantity in English inches, as deduced from these two experiments, is 0.04622.

Experiments with Alcohol.

Diameter of the tube.	Height of ascent above lowest point of concavity.	Density of alcohol.
1.29441 millim.	9.18235 millim.	0.81961
1.90381	6.08397	0.81961
1.29441	9,30079	0.8595
1.29441	9,99727	0.94153
[3] 10.508	0.3835	0.81347

The temperature of the alcohol was 8°.5 centig., and the constant quantity for the two first experiments, reduced to English inches, is 0.01815, which agrees remarkably with 0.0178, the constant quantity in Sir David Brewster's experiments.

Experiments with Oil of Turpentine.

Diameter of tube.	Height of fluid.	Density.
1.29441 millim.	9.95159	0.869458

This result also coincides very nearly with that of Sir David Brewster.

General results.

146. The following table contains a general view of the results obtained by different philosophers, from the ascent of *water* in capillary tubes.

Names of observers.	Constant quantity, in English inches.
Sir Isaac Newton,[4]	0.020
MM. Haüy and Tremery,	0.021
M. Carré, mean of three observations,	0.022
M. Hallstrom,	0.026
Sir David Brewster,	0.033
Muschenbroek,	0.039
M. Weitbrecht, average of his results,	0.042
M. Gay-Lussac, average of 2 observations,	0.046
Benjamin Martin,	0.048
Mr Atwood,	0.053
James Bernoulli,	0.064

Cause of the discrepancies in the measures.

Throwing aside the measure of James Bernouilli as obviously erroneous, we obtain 0.035 as the general average result of the preceding means; but the difference between this and the extreme measures of Newton and Atwood is so great, that there must be some cause, different from an error of observation, to which it is owing. The difference between the results obtained by Sir David Brewster and M. Gay-Lussac, made with nice instruments founded on the same principle, leads to the same conclusion. La Place indeed has ascribed, and we think justly, these differences to the *greater* or *less* degree of humidity on the sides of the tubes; and he informs us that Gay Lussac made his experiments with tubes *very much wetted*. Here, then, we have at once the cause of the difference above mentioned, because the experiments of Sir David Brewster

[1] Dr Young found the height of ascent of water and diluted spirit of wine to be as 100 to 64.

[2] See Biot's *Traité de Physique.*

[3] This is a mean of *five* experiments.

[4] *Optics*, p. 366, 3d edition.

Capillary Attraction, &c.

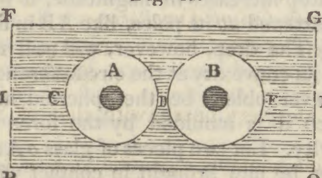
were made with a tube *carefully cleaned and dried after each experiment.* A dry tube must necessarily raise the water to a less height than a wet one, and the difference must increase as the diameter of the tube employed is diminished. If we conceive a tube, indeed, with an exceedingly small bore, wetted over the whole of its interior, in the slightest degree, the *two* inner surfaces of the film would nearly meet in the axis, and the height of ascent would be infinite, or as high as the tube was long.

147. From these observations, the reader will be already prepared to draw the conclusion, that the ascent of fluids in glass tubes is a very equivocal measure of the force of capillary attraction, independent of its being applicable only to the single substance of glass.

Different method of measuring capillary attraction.

With the view of removing this objection, Sir David Brewster long ago constructed an instrument, the object of which was to measure, upon an optical principle, the diameter of the circle of fluid which any cylindrical solid raises by capillary attraction above its general level. Thus let MN (fig. 41.) be the plan of a vessel filled with fluid, and A the section of a vertical cylinder of well cleaned and well dried glass, or any other substance not porous. This solid A will raise the fluid to a certain height around it, elevating a circular portion CD of the fluid above the general level; and it is manifest that the diameter CD of this elevated portion will be proportioned to the height of the fluid round the sides of the cylinder, or to the capillary force by which it is raised. In order to measure the diameter of this circle of fluid, a micrometer carries a small vertical frame along the edge FG of the vessel. Along this frame are stretched two fine parallel wires, whose images can be seen by reflection from the surface of the fluid, by an eye on the side PQ of the vessel, aided by a microscope with a distant focus. When the image of these wires is seen by reflection from any part of the fluid surface without the circle CD, it will suffer no change of form; but when it is seen by reflection from any portion of the elevated portion CD, the fibres will appear disturbed, and will indicate, by their return to the rectilineal form of accurate parallelism, the apparent termination of the circle CD. The same observation is made on the other side of A, at the boundary D, and a measure is thus obtained of the diameter of the circle CD, by means of the micrometer screw, by which the microscope on the side PQ, and the wire frame on the side FG are moved (being fixed to the same frame) along the sides of the vessel. In this way solids of all kinds may be used, and their exterior or acting surfaces may be easily cleared from grease and other adhering substances.

Fig. 41.



This apparatus may be improved by using two cylinders A,B in place of one, and by moving one of them, suppose B, from the other A till the two elevated circular portions CD,DE disturb the images of the wires, seen by reflexion from the intermediate point at D.

The motion of water in capillary tubes accelerated by electricity and by heat.

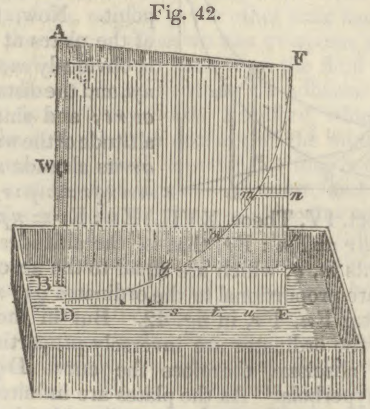
148. When water is made to pass through a capillary tube of such a bore that the fluid is discharged only by successive drops; the tube, when electrified, will furnish a constant and accelerated stream, and the acceleration is proportional to the smallness of the bore. A similar effect may be produced by employing warm water. Sir John Leslie found that a jet of warm water rose to a much greater height than a jet of cold water, though the water in both cases moved through the same aperture, and was influenced by the same pressure. A syphon also, which discharged cold water only by drops, furnished warm water in an uninterrupted stream.

Capillary Attraction, &c.

On the ascent of fluids between two inclined plates of glass.

149. Such are the leading phenomena of capillary tubes. The rise of fluids between two plates of glass remains to be considered; and while it furnishes us with a very beautiful experiment, it confirms the reasoning by which we have accounted for the elevation of fluids in cylindrical canals. Let ABEF and CDEF be two places of plate glass with

Fig. 42.



smooth and clean surfaces, having their sides EF joined together with wax, and their sides AB, CD kept a little distance by another piece of wax W, so that their interior surfaces, whose common intersection is the line EF, may form a small angle. When this apparatus is immersed in a vessel MN full of water, the fluid will rise in such a manner between the glass planes as to form the curve DqomF, which represents the surface of the elevated water. By measuring the ordinates mn, op, &c. of this curve, and also its abscissæ Fn, Fp, &c. Mr Hawksbee found it to be the common Apollonian hyperbola, having for its assymptotes the surface DE of the fluid, and EF the common intersection of the two planes. The following are the results which he obtained when the inclination of the planes was 20′:—

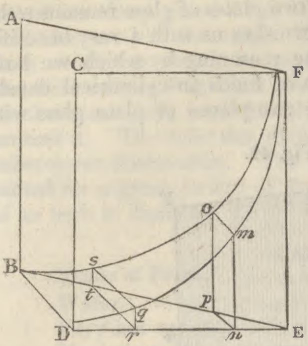
Experiments of Hawksbee.

Distances from the touching ends of the planes.	Heights of the water at the preceding distances.
13 inches	1
9	2
7	3
6	3¾
5	5
4	6¾
3	9
2½	12
2	15½
1¾	18
1½	21½
1¼	27½
1	35
¾	50
½	76

By repeating these observations at inclinations of 40′, and at various other angles, Mr Hawksbee found that the curve was an exact hyperbola in all directions of the planes. To the very same conclusion we are led by the principles already laid down; for as the distance between the plates diminishes at every point of the curve DqomF from D towards F, the water ought to rise higher at o than at q, still higher at m, and highest of all at F, where the distance between the plates is a minimum. To illustrate this more clearly, let ABEF and CDEF (fig. 43.) be the same plates of glass (inclined at a greater angle for the sake of distinctness), and let FmqD, and FosB be the curves which bound the surface of the elevated fluid. Then, since the altitudes of the water in capillary tubes are in-

Capillary Attraction, &c.

Fig. 43.



versely as their diameters, or the distances of their opposite sides, the altitudes of the water between two glass plates, should at any given point be inversely as the distances of the plates at that point. Now, the distance of the plates at the point m is obviously mo, or its equal np, and the distance at q is qs or rt; and since mn is the altitude of the water at m, and qr its altitude at q, we have $mn:qr=np:rt$; but (GEOMETRY, Sect. IV. Theor. XVII.) $En:Er=np:rt$; therefore $mn:qr=Fn:Fr$, that is, the altitudes of the fluid at the points m, q, which are equal to the abscissæ Fn, Fr (fig. 42.) are proportional to the ordinates qr, mn, equal to the abscissæ Fn, Fr, in fig. 42. But in the Apollonian hyperbola the ordinates are inversely proportional to their respective abscissæ, therefore the curve $DqmF$ is the common hyperbola. As the plates are infinitely near each other at the apex F, the water will evidently rise to that point, whatever be the height of the plates.

Ascent of fluids between parallel plates.

150. Mr Hawksbee extended his experiments to plates of glass placed parallel to each other, and separated to different distances, and he obtained the following results:—

Distance of plates.	Height of Ascent.	Constant quantity.
0.0625 of an inch.	0.166 of an inch.	0.0104
0.03125 ...	0.333 ...	0.0104
0.015625 ...	0.666 ...	0.0104
0.007802 ...	1.333 ...	0.0104

The following experiments on the same subject have been more recently made by M. Monge, MM. Haüy and Tremery, and M. Gay-Lussac.

In those made by M. Monge, the plates were first cleaned with caustic alkali, and well washed. Their degree of separation was ascertained by silver wires of different thicknesses, and the fluid used was the filtered water of the Seine. The following were the results:—

Distance of plates in parts of a line.	Height of ascent.	Constant quantity.
$\frac{4}{33}$ or 0.0101 inch.	15.5 lines.	0.1565
$\frac{4}{49}$ 0.0068	33.5	0.2278
$\frac{1}{28}$ 0.0030	74	0.222

The following result was obtained by MM. Haüy and Tremery:—

Distance of plate.	Height of ascent.	Const. quan.
1 millimètre.	6.5 millimètre.	6.5

The following measures were obtained by M. Gay-Lussac, with plates of glass ground perfectly flat:—

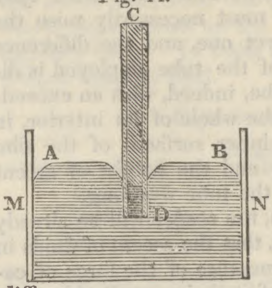
Distance of plates.	Height of Ascent above lowest point of concavity.	Temp. centig.
1.069 millimètre.	13.574	16°

Here the constant quantity is 14,51, or 0.02251, when reduced to English inches for a distance of $\frac{1}{100}$th of an inch.

151. The phenomena which we have been considering are all referrible to one simple fact, that the particles of glass have a stronger attraction for the particles of water than the particles of water have for each other. This is the case with almost all other fluids except mercury, the particles of which have a stronger attraction for each other than for glass. When capillary tubes, therefore, are plunged in this fluid, a new series of phenomena present themselves to our consideration. Let MN (fig. 44) be a vessel full of

Mercury descends in capillary tubes.

Fig. 44.



mercury. Plunge into the fluid the capillary tube CD; and the mercury, instead of rising in the tube, will remain stationary at E, its depression below the level surface AB being inversely proportional to the diameter of the bore. This was formerly ascribed to a repulsive force supposed to exist between mercury and glass, but we shall presently see that it is owing to a very different cause.

Capillary Attraction, &c.

152. That the particles of mercury have a very strong attraction for each other, appears from the globular form which a small portion of that fluid assumes, and from the resistance which it opposes to any separation of its parts. If a quantity of mercury is separated into a number of minute parts, all these parts will be spherical; and if two of these spheres be brought into contact, they will instantly rush together, and form a single drop of the same form. There is also a very small degree of attraction existing between glass and mercury; for a globule of the latter very readily adheres to the lower surface of a plate of glass. Now, suppose a drop of water laid upon a surface anointed with grease, to prevent the attraction of cohesion from reducing it to a film of fluid, this drop, if very small, will be spherical. If its size is considerable, the gravity of its parts will make it spheroidal, and as the drop increases in magnitude, it will become more and more flattened at its poles, like AB in fig. 45. The drop, however, will still retain its convexity at the circumference, however oblate be the spheroid into which it is moulded by the force of gravity. Let two pieces of glass oAm, pBn, be now brought in contact with the circumference of the drop; the mutual attraction between the particles of water which enabled it to preserve the convexity of its circumference, will yield to their superior attraction for glass; the space m, n, o, p, will be immediately filled; and the water will rise on the sides of the glass, and the drop will have the appearance of AB in fig. 46. If the drop AB (fig. 45.) be now supposed mercury instead of water, it will also, by the gravity of its parts, assume the form of an oblate spheroid; but when the pieces of glass oAm, pBn are brought close to its periphery, their attractive force upon the mercurial particles is not sufficient to counteract the mutual attraction of these particles; the mercury, therefore, retains its convexity at the circumference, and assumes the form exhibited in fig. 47. The small spaces op being filled by the pressure of the superincumbent fluid, while the spaces below m, n, still remain between the glass and the mercury. Now if the two plates of glass A, B be made to approach each other, the depressions m, n will still continue, and when the distance of the plates is so small that these depressions or indentations meet, the mercury will sink between the plates, and its descent will continue as the pieces of glass approach. Hence the depression of the mercury in capillary tubes becomes very intelligible. If two glass planes forming a small angle, as in fig. 42, be immersed in a vessel of mercury, the fluid will sink below the surface of the mercury in the vessel, and form an Apollonian hyperbola like DoF, having for its asymptotes the common intersection of the planes and the surface of mercury in the vessel.

Fig. 45.

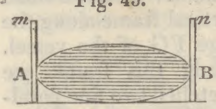


Fig. 46.

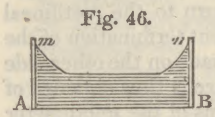
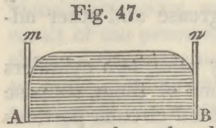


Fig. 47.



Mercury has a stronger attraction for its own particles than for glass.

Cause of the depression of mercury in capillary tubes.

153. The depression of mercury in capillary tubes is evidently owing to the greater attraction that subsists be-

tween the particles of mercury and those of glass. The difference between these two attractions, however, arises from an imperfect contact between the mercury and the capillary tube, occasioned by the interposition of a thin coating of water which generally lines the interior surface of the tube, and weakens the mutual action of the glass and mercury; for this action always increases as the thickness of the interposed film is diminished by boiling. In the experiments which were made by Laplace and Lavoisier on barometers, by boiling the mercury in them for a long time, the convexity of the interior surface of the mercury was often made to disappear. They even succeeded in rendering it concave, but could always restore the convexity by introducing a drop of water into the tube. When the ebullition of the mercury is sufficiently strong to expel all foreign particles, it often rises to the level of the surrounding fluid, and the depression is even converted into an elevation.

he depression of ercury in ass tubes, ultimately owing to imperfect contact between the lid and e fluid.

154. Between mercury and water there is likely to be some fluid in which the attraction of the glass for its particles is nearly equal to half the attraction of the fluid for itself. Sir David Brewster has observed that iodine dissolved in chloride of sulphur approximates to this condition; but not having the chloride by itself, he could not observe whether or not the effect is produced or influenced by the iodine. If it is, then a solution may be obtained, in which the above condition is perfect. The solution of the iodine already mentioned scarcely rises on the sides of the glass ball which contains it. (See 162.)

chard's xperiments on ne force ecessary raise the rface of solid om the rface of ater.

155. As most philosophers seem to agree in thinking that all the capillary phenomena are referable to the cohesive attraction of the superficial particles only of the fluid, a variety of experiments has been made in order to determine the force required to raise a horizontal solid surface from the surface of a fluid. Mr Achard found that a disc of glass, $1\frac{1}{2}$ French inches in diameter, required a weight of 91 French grains to raise it from the surface of the water at 69° of Fahrenheit, which is only 37 English grains for each square inch. At $44\frac{1}{2}$ of Fahrenheit the force was $\frac{1}{14}$ greater, or $39\frac{1}{2}$ grains, the difference being $\frac{1}{143}$ for each degree of Fahrenheit. From these experiments Dr Young concludes that the height of ascent in a tube of a given bore, which varies in the duplicate ratio of the height of adhesion, is diminished about $\frac{1}{180}$ for every degree of Fahrenheit that the temperature is raised above 50°; and he conjectures that there must have been some considerable source of error in Achard's experiments, as he never found this diminution to exceed $\frac{1}{1000}$. According to the experiments of Dutour, the force necessary to elevate the solid, or the quantity of water raised, is equal to 44.1 grains for every square inch.

Iorveau's xperiments on ne force ecessary raise etals om the rface of ercury.

156. According to the experiments of Morveau, the force necessary to elevate a circular inch of gold from the surface of mercury is 446 grains; a circular inch of silver, 429 grains; a circular inch of tin, 418 grains; a circular inch of lead, 397 grains; a circular inch of bismuth, 372 grains; a circular inch of zinc, 204 grains; a circular inch of copper, 142 grains; a circular inch of metallic antimony, 126; a circular inch of iron, 115 grains; and a similar surface of cobalt required 8 grains. The order in which these metals are arranged is the very order in which they are most easily amalgamated with mercury.

ay-Lussac's.

The most recent experiments on the adhesion of surfaces to fluids have been made by M. Gay-Lussac, who obtained the following results with a circular plate of glass 118.366 millimetres in diameter:—

Names of fluids.	Weight necessary to raise the plate from the glass.	Specific gravity.
Water, . .	59.40 grammes.	1.000
Alcohol, . .	31.08 ...	0.8196
Alcohol, . .	32.87 ...	0.8595
Oil of turpentine,	37.152 ...	0.9415

With a copper disc, 116.604 millimetres in diameter, the weight necessary to raise it from water, at the temperature of 18°.5 centigrade, was 57.945 grammes, differing very little, if at all, from glass, for the diminution of weight may be explained by the circumstance of the copper disc being nearly *two* millimeters less in diameter than the glass. In these experiments the discs were suspended from the scale of a balance, and the weights in the other scale successively increased till the force of adhesion was overcome at the instant when the disc detached itself from the fluid surface.

Experiments of Count Rumford on the adhesion of fluids.

157. A number of experiments on the adhesion of fluids have been lately made by Count Rumford, which authorize him to conclude, that on account of the mutual adhesion of the particles of fluid, a pellicle or film is formed at the superior and inferior surfaces of water, and that the force of the film to resist the descent of bodies specifically heavier than the fluid increases with the viscidity of the water. He poured a stratum of sulphuric ether upon a quantity of water, and introduced a variety of bodies specifically heavier than water into this compound fluid. A sewing needle, granulated tin, and small globules of mercury, descended through the ether, but floated upon the surface of the water. When the eye was placed below the level of the aqueous surface, the floating body, which was a spherule of mercury, seemed suspended in a kind of bag a little below the surface. When a larger spherule of mercury was employed, about the 40th or 50th of an inch in diameter, it broke the pellicle and descended to the bottom. The same results were obtained by using essential oil of turpentine or oil of olives instead of ether. When a stratum of alcohol was incumbent upon the water, a quantity of very fine powder of tin thrown upon its surface, descended to the very bottom, without seeming to have met with any resistance from the film at the surface of the water. This unexpected result Count Rumford endeavours to explain by supposing that the aqueous film was destroyed by the chemical action of the alcohol. In order to ascertain with greater accuracy the existence of a pellicle at the surface of the water, Count Rumford employed a cylindrical glass vessel 10 inches high and $1\frac{1}{2}$ inch in diameter, and filled it with water and ether as before. A number of small bodies thrown into the vessel descended through the ether and floated on the surface of the water. When the whole was perfectly tranquil, he turned the cylinder three or four times round with considerable rapidity in a vertical position. The floating bodies turned round along with the glass, and stopped when it was stopped; but the liquid water below the surface did not at first begin to turn along with the glass; and its motion of rotation did not cease with the motion of the vessel. From this Count Rumford concludes that there was a real pellicle at the surface of the water, and that this pellicle was strongly attached to the sides of the glass, so as to move along with it. When this pellicle was touched by the point of a needle, all the small bodies upon its surface trembled at the same time. The apparatus was allowed to stand till the ether had entirely evaporated, and when the pellicle was examined with a magnifier, it was in the same state as formerly; and the floating bodies had the same relative positions.

In order to shew that a pellicle was formed at the inferior surface of water, Count Rumford poured water upon mercury, and upon that a stratum of ether. He threw into the vessel a spherule of mercury about one-third of a line in diameter, which being too heavy to be supported by the pellicle at the superior surface of the water, broke it, and descending through that fluid, was stopped at its inferior surface. When this spherule was moved, and even compressed with a feather, it still preserved its spherical form, and refused to mix with the mass of mercury. When the viscidity of the water was increased by the infusion of gum-arabic, much larger spherules were supported by the

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pellicle. From the very rapid evaporation of ether, and its inability to support the lightest particles of a solid upon its surface, Count Rumford very justly concludes, that the mutual adhesion of its particles is very small.

Apparent attraction of floating bodies.

158. The approach of two floating bodies has been ascribed by some to their mutual attraction, and by others to the attraction of the portions of fluid that are raised round each by the attraction of cohesion. Dr Young, however, observes, that the approach of the two floating bodies is produced by the excess of the atmospheric pressure on the remote sides of the solids, above its pressure on their neighbouring sides; or, if the experiments are performed in a vacuum, by the equivalent hydrostatic pressure or suction derived from the weight and immediate cohesion of the intervening fluid. This force varies alternately in the inverse ratio of the square of the distance; for when the two bodies approach each other, the altitude of the fluid between them is increased in the simple inverse ratio of the distance; and the mean action, or the negative pressure of the fluid on each particle of the surface, is also increased in the same ratio. When the floating bodies are surrounded by a depression, the same law prevails, and its demonstration is still more simple and obvious.

Theory of Dr Young.

Of Monge.

159. A different view of the subject has been given by Monge, who made a number of accurate experiments on the subject, and deduced from them the following laws:—

1. If two floating bodies, capable of being wetted with the fluid on which they float, are placed near each other, they will approach as if mutually attracted.

In order to explain this law, let AB, CD (fig. 48.) be two suspended plates of glass, placed at such distance that the

Fig. 48.

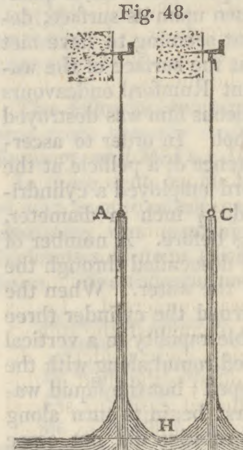
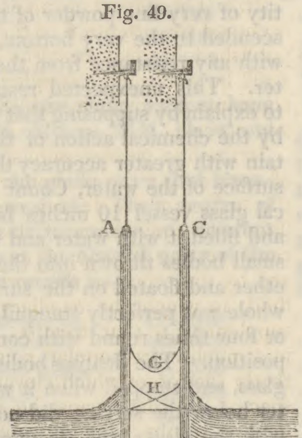
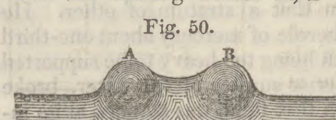


Fig. 49.



point H where the two portions of elevated fluid meet, is on a level with the rest of the water, the two plates will remain stationary and in perfect equilibrium. But if they are brought nearer one another, as in fig. 49, the water will rise between them to a point H above the level, and by a nearer approximation, to the point G. The water thus elevated, acting like a curved chain hung to the two plates, attracts the sides of the plates, and brings them together in a horizontal direction. The very same thing takes place with the floating bodies A, B placed at such a distance that the water rises between them above its level, and hence these bodies will approach by the attraction of the fluid on their inner sides.

Fig. 50.



2. When the two floating bodies A, B, are not capable of being wetted, they will approach each other as if mutually attracted, when they are placed near one another.

Fig. 51.

In this case the fluid is depressed between them below its natural level H, and the two bodies are pressed *inwards* or towards each other, which pressure being greater than the pressure *outwards* of the fluid between them, they will approach each other by the action of the difference of these pressures.

3. If one of the bodies A, is capable of being wetted, and the other B not, as shewn in the figure, they will recede from each other as if mutually repelled.

Fig. 52.

As the fluid rises round A, and is depressed round B, the depression round B will not be equal all round, and hence the body B, being placed as if on an inclined plane, it will move to the right hand when the pressure is the least.

In this last case, La Place was led by theory to believe that when B is placed very near A, the repulsion will be converted into attraction. M. Haüy tried this experiment with planes of ivory and talc, the former being incapable of being wetted with water and the latter not; and he found, in conformity with La Place's prediction, that at a certain short distance the talc moved suddenly into contact with the ivory.

Phenomena of lighted wicks and camphor.

160. The phenomena of attraction and repulsion exhibited between small lighted wicks, swimming in a basin of oil, and the motions of floating evaporable substances like camphor, and also of potassium and light substances, such as cork, impregnated with ether, have been sometimes treated under this head. The first of these classes of phenomena arise from an unbalanced pressure upon the floating wick, arising from a difference of temperature of different parts of the oil, and the movements of the second class arise from the reaction of the currents of vapour which flow from the floating substances. A full account of these phenomena will be found in the *Edinburgh Transactions* (vol. iv. p. 44), in the *Mémoires Presentées à L'Institut* (tom. i. p. 125), and the more recent observations of Matteucci, in the *Annales de Chimie* (June 1833, tom. liii. p. 216–219.)

Theory of Capillary Attraction.

Theory of capillary attraction Fig. 53.

161. Clairaut was the first mathematician who attempted to analyze the forces which contribute to the ascent of fluids in capillary tubes.[1] After pointing out the insufficiency of preceding theories, he gives an analysis of the different forces which contribute to the suspension of fluids in capillary tubes.

Let ABCDEFGH (fig. 53.) be the section of a capillary tube, MNP the surface of the water in the vessel, I*i* the height of its ascent, viz. the concave surface of the fluid column, and IKLM an indefinitely small column of fluid reaching to the surface at M. Now the column ML is solicited by the force of gravity which acts through the whole extent of the column, and by the reciprocal attraction of the moleculæ, which, though they act the same in all the points of the column, only exhibit their effects towards the extremity M. If any particle *e* is taken at a less distance from the surface than the distance at which the attraction of the liquid generally terminates, and if *mn* is a plane parallel to MN, and at the same distance from the particle *e*,

[1] *Théorie de la Figure de la Terre*, chap. x. Paris, 1743, 1808.

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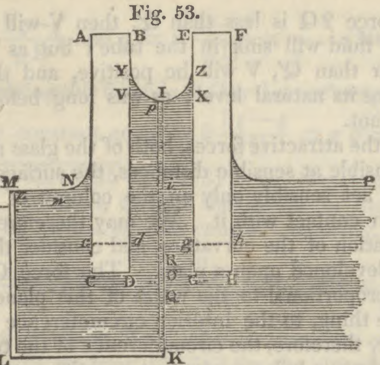
then this particle will be equally attracted by the water be-

Fig. 53.



tween the planes MN, *mn*. The water, however, below *mn*, will attract the particle downwards, and this effect will take place as far as the distance where the attraction ceases.

The column IK, on the other hand, which is in a state of equilibrium with ML, is acted upon by the force of gravity through the whole extent of the column, also by other forces at the upper and lower extremities of the tube. The forces exerted at the upper part of the column are, the attraction of the tube upon the particles of water, and the reciprocal attraction of these particles; but as every particle is as much drawn upwards as downwards by the first of these forces, the consideration of it may be dropped. In order to estimate the other force, let a horizontal plane VX touch the concavity at I, a particle p, situated infinitely near to I, is attracted by all the particles above VX, and by all below it whose sphere of activity comprehends that particle; and as the particles above p are fewer than those below it, the result of these forces must be a force acting downwards.

In order to estimate the value of the forces which act at the lower end O of the tube, let us suppose that the tube has a prolongation to the bottom of the vessel, formed of matter of the same density as the water. Let a particle R be situated a little above the extremity of the tube, and another Q as much below that extremity, they will be equally acted upon by the water above that place, and by the water between the fictitious prolongation of the tube, and therefore these forces will destroy one another.

By applying to the case of the particle R the same reasoning that was used for the particle e, it will appear that the result of its attraction by the tube is an attraction upwards. The particle R is likewise attracted downwards by the supposed prolongation of the tube, and the difference between these is the real effect. The other particle Q is also drawn upwards by the tube with the same force as R, since, by the hypothesis, it is as far distant from the points D, G, as the particle R is from the points d, g, where, with respect to it, the real attraction of the tube commences. The particle Q is attracted also downwards, by the supposed prolongation of the tube, and the difference of these actions is the real effect. Hence the double of this force is the sum of all the forces that act at the lower part of the tube. These forces, when combined with those exerted at the top of the tube, and with the force of gravity, give the total expression, which should be combined with that of the forces with which the column ML is actuated.

The formula obtained by Clairaut for the altitude I i, fig. 53, is

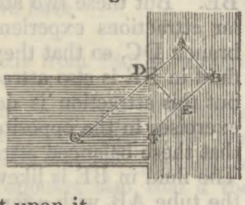
$$\mathrm{I}\,i = \frac{(2Q - Q').\int dx\,[b, x] + \int dx\left[b,\ x,\ Q,\ Q'\right]}{p}$$

in which Q is the intensity of the attraction of the glass, Q′ the intensity of the attraction of the water, b the interior radius of the tube, and p the force of gravity.

Clairaut then observes, that there is an infinitude of possible laws of attraction which will give a sensible quantity for the elevation of the fluid I i above the level MN, when the diameter of the tube is very small, and a quantity next to nothing when the diameter is considerable; and he remarks, that we may select the law which gives the inverse ratio between the diameter of the tube and the height of the liquid, conformable to experiment.

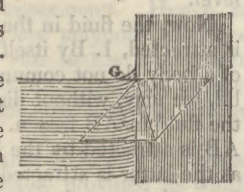
162. It follows from the preceding formula, that if any solid AB possesses half the attracting power of the fluid CD, the surface of the fluid will remain horizontal; for the attraction being represented by DA, DE, and DC, DA and DE may be combined into DB, and DB and DC into DE, which is vertical. The water will therefore not be raised, since the surface of a fluid at rest must be perpendicular to the resulting direction of all the forces which act upon it.

Fig. 54.



When the attracting power of the solid is more than half as great, the resultant of the forces will be GF in fig. 55, and therefore the fluid must rise towards the solid, in order to be perpendicular to GF. When the attractive power of the solid is less than that of the fluid, the resultant will be HF in fig. 55; and therefore, as in the case of mercury, the surface must be depressed, in order to be perpendicular to the force.

Fig. 55.



163. The subject of capillary attraction has more recently occupied the attention of the late Marquis de la Place, who published his first remarks on the subject in 1806. In 1807 he published a supplement to his theory, in which he compares his formula with the experiments of Gay-Lussac and others.

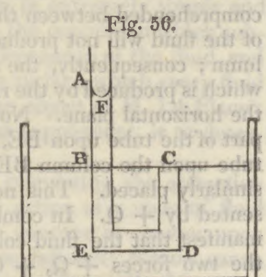
Account of La Place's Theory.

In the first treatise published by M. La Place, his method of considering the phenomena was founded on the form of the surface of the fluid in capillary spaces, and on the conditions of equilibrium of this fluid in an infinitely narrow canal, resting by one of its extremities upon this surface, and by the other on the horizontal surfaces of an indefinite fluid, in which the capillary tube was immersed. In his supplement to that treatise, he has examined the subject in a much more popular point of view, by considering directly the forces which elevate and depress the fluid in this space. By this means, he is conducted easily to several general results, which it would have been difficult to obtain directly by his former method. Of this method we shall endeavour to give as clear a view as possible.

Analysis of the capillary forces.

164. Let AB, fig. 56, be a vertical tube whose sides are perpendicular to its base, and which is immersed in a fluid that rises in the interior of the tube above its natural level. A thin film of fluid is first raised by the action of the sides of the tube; this film raises a second film, and this second film a third film, till the weight of the volume of fluid raised exactly balances all the forces by which it is actuated. Hence it is obvious, that the elevation of the column is produced by the attraction of the tube upon the fluid, and the attraction of the fluid for itself. Let us suppose that the inner surface of the tube AB is prolonged to E, and after bending itself horizontally in the direction ED, that it assumes a vertical direction DC; and let us suppose the sides of this tube to be so extremely thin, or to be

Fig. 56.



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formed of a film of ice, so as to have no action on the fluid which it contains, and not to prevent the reciprocal action which takes place between the particles of the first tube AB and the particles of the fluid. Now, since the fluid in the tubes AE, CD, is in equilibrio, it is obvious that the excess of pressure of the fluid in AE is destroyed by the vertical attraction of the tube and of the fluid upon the fluid contained in AB. In analyzing these different attractions, La Place considered first those which take place under the tube AB. The fluid column BE is attracted, 1. by itself; 2. by the fluid surrounding the tube BE. But these two attractions are destroyed by the similar attractions experienced by the fluid contained in the branch DC, so that they may be entirely neglected. The fluid in BE is also attracted vertically by the fluid in AB; but this attraction is destroyed by the attraction which it exercises in the opposite direction upon the fluid in BE, so that these balanced attractions may likewise be neglected. The fluid in BE is likewise attracted vertically upwards by the tube AB, with a force which we shall call Q, and which contributes to destroy the excess of pressure exerted upon it by the column BF raised in the tube above its natural level.

Now, the fluid in the lower part of the round tube AB is attracted, 1. By itself; but as the reciprocal attractions of a body do not communicate to it any motion if it is solid, we may, without disturbing the equilibrium, conceive the fluid in AB frozen. 2. The fluid in the lower part of AB is attracted by the interior fluid of the tube BE, but as the latter is attracted upwards by the same force, these two actions may be neglected as balancing each other. 3. The fluid in the lower part of BE is attracted by the fluid which surrounds the ideal tube BE, and the result of this attraction is a vertical force acting downwards, which we may call $-Q'$, the contrary sign being applied, as the force is here opposite to the other force Q. As it is highly probable that the attractive forces exercised by the glass and the water vary according to the same function of the distance, so as to differ only in their intensities, we may employ the constant co-efficients ϱ, ϱ' as measures of their intensity, so that the forces Q and $-Q'$ will be proportional to ϱ, ϱ'; for the interior surface of the fluid which surrounds the tube BE, is the same as the interior surface of the tube AB. Consequently, the two masses, viz. the glass in AB, and the fluid round BE differ only in their thickness; but as the attraction of both these masses is insensible at sensible distances, the difference of their thicknesses, provided their thicknesses be sensible, will produce no difference in the attractions. 4. The fluid in the tube AB is also acted upon by another force, namely, by the sides of the tube AB in which it is inclosed. If we conceive the column FB divided into an infinite number of elementary vertical columns, and if at the upper extremity of one of these columns we draw a horizontal plane, the portion of the tube comprehended between the plane and the level surface BC of the fluid will not produce any vertical force upon the column; consequently, the only active vertical force is that which is produced by the ring of the tube immediately above the horizontal plane. Now, the vertical attraction of this part of the tube upon BE, will be equal to that of the entire tube upon the column BE, which is equal in diameter, and similarly placed. This new force will therefore be represented by $+Q$. In combining these different forces, it is manifest that the fluid column BF is attracted upwards by the two forces $+Q$, $+Q$, and downwards by the force $-Q'$; consequently the force with which it is raised upwards will be $2Q-Q'$. If we represent by V the volume of the column BE, by D its intensity, and by g the force of gravity, then gDV will represent the weight of the elevated column; but as this weight is in equilibrio with the forces by which it is elevated, we have the following equation:

$$gDV = 2Q - Q'.$$

If the force $2Q$ is less than Q', then V will be negative, and the fluid will sink in the tube; but as long as $2Q$ is greater than Q', V will be positive, and the fluid will rise above its natural level; as was long before shewn by M. Clairaut.

Since the attractive forces, both of the glass and the fluid, are insensible at sensible distances, the surface of the tube AB will act sensibly only on the column of fluid immediately in contact with it. We may therefore neglect the consideration of the curvature, and consider the inner surface as developed upon a plane. The force Q will therefore be proportional to the width of this plane, or what is the same thing, to the interior circumference of the tube. Calling c, therefore, the circumference of the tube, we shall have $Q = \varrho c$; ϱ being a constant quantity, representing the intensity of the attraction of the tube AB upon the fluid, in the case where the attractions of different bodies are expressed by the same function of the distance. In every case, however, ϱ expresses a quantity dependent on the attraction of the matter of the tube, and independent of its figure and magnitude. In like manner we shall have $Q' = \varrho' c$; ϱ' expressing the same thing with regard to the attraction of the fluid for itself, that ϱ expressed with regard to the attraction of the tube for the fluid. By substituting these values of Q Q', in the preceding equation, we have

$$gDV = c(2\varrho - \varrho').$$

If we now substitute, in this general formula, the value of c in terms of the radius if it is a capillary tube, or in terms of the sides if the section is a rectangle, and the value of V in terms of the radius and altitude of the fluid column, we shall obtain an equation by which the heights of ascent may be calculated for tubes of all diameters, after the height, belonging to any given diameter, has been ascertained by direct experiment.

Application of the formula to cylindrical tubes;

165. In the case of a cylindrical tube, let π represent the ratio of the circumference to the diameter, h the height of the fluid column reckoned from the lower point of the meniscus, q the mean height to which the fluid rises, or the height at which the fluid would stand if the meniscus were to fall down and assume a level surface, then we have πr^3 for the solid contents of a cylinder of the same height and radius as the meniscus, and as the meniscus, added to the solid contents of the hemisphere of the same radius, must be equal to πr^2, we have $\pi r^3 - \frac{2\pi r^3}{3}$, or $\frac{\pi r^3}{3}$, for the solid contents of the meniscus. But since $\frac{\pi r^3}{3} = \pi r^2 \times \frac{r}{3}$, it follows that the meniscus $\frac{\pi r^3}{3}$ is equal to a cylinder whose base is πr^2, and altitude $\frac{r}{3}$. Hence, we have

$$q = h + \frac{r}{3};$$

or what is the same thing, the mean altitude q in a cylinder is always equal to the altitude h of the lower point of the concavity of the meniscus increased by one-third of the radius, or one-sixth of the diameter of the capillary tube. Now, since the contour c of the tube $= 2\pi\varrho$, and since the volume V of water raised is equal to $q \times \pi r^2$, we have, by substituting these values in the general formula,

$$gDq\pi r^2 = 2\pi r(2\varrho - \varrho'), \quad \text{(No 1.)}$$

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and dividing by πr and g D, we have,

$$r\,q = 2\,\frac{2\varrho-\varrho'}{g\text{D}} \text{ and } q = 2\,\frac{2\varrho-\varrho'}{g\text{D}} \times \frac{1}{r}. \quad \text{(No. 2.)}$$

plica- n of the mula Gay- ussac's peri- nts on ter;

166. In applying this formula to Gay-Lussac's experiments, we have the constant quantity $2\,\frac{2\varrho-\varrho}{g\text{D}} = r\,q = \overline{647205 \times 23,1634 + 0,215735} = 15,1311$ for Gay-Lussac's 1st experiment. In order to find the height of the fluid in his 2d tube by means of this constant quantity, we have

$$r = \frac{1.90381}{2} = 0.951905, \text{ and } 2\,\frac{2\varrho-\varrho'}{g\text{D}} \times \frac{1}{3} = q = \frac{15,1311}{0.951095}$$

$= 15.8956$, from which, if we subtract one-sixth of the diameter, or 0.3173, we have 15.5783 for the altitude h of the lower point of the concavity of the meniscus, which differs only 0.0078 from 15.861 the observed altitude.

Gay- ussac's peri- nts on ohol;

If we apply the same formula to Gay-Lussac's experiments on alcohol, we shall find the constant quantity $2\,\frac{2\varrho-\varrho'}{g\text{D}} = 6.0825$ as deduced from the 1st experiment, and $h = 6.0725$, which differs only 0.0100 from 6.08397, the altitude observed.

From these comparisons, it is obvious that the mean altitudes, or the values of q, are very nearly reciprocally proportional to the diameters of the tubes; for, in the experiments on water, the value of q deduced from this ratio is 15.895, which differs little from 15.9034, the value found from experiment; and that, in accurate experiments, the correction made by the addition of the sixth part of the diameter of the tube is indispensably requisite.

rectan- ar ca- lary ces.

167. If the section of the pipe in which the fluid ascends is a rectangle, whose greater side is a, and its lesser side d, then the base of the elevated column will be $= a\,d$, and its perimeter $c = 2\,a + 2\,d$. Hence, the value of the meniscus will be $\frac{a\,d^2}{2} - \frac{a\,\pi\,d^2}{8} = \frac{a\,d^2}{2}\left(1 - \frac{\pi}{4}\right)$, that is $q = h + \frac{d}{2}\left(1 - \frac{\pi}{4}\right)$. Hence, if in the general equation No. 1, we substitute for c its equal $2a + 2d$, and for V its equal adq, we have

$$g\text{D}\,q\,a\,d = \overline{2\varrho-\varrho'} \times \overline{2a+2d},$$

and dividing by a and by g D, we have

$$d\,q = 2\,\frac{2\varrho-\varrho'}{g\text{D}} \times 1 + \frac{d}{a}, \text{ and}$$

$$q = \frac{2\,\frac{2\varrho-\varrho'}{g\text{D}} \times 1 + \frac{d}{a}\,.}{d}$$

In applying this formula to the elevation of water between two glass plates, the side a is very great compared with d, and therefore the quantity $\frac{d}{a}$ being almost insensible, may be safely neglected. Hence the formula becomes

$$q = 2\,\frac{2\varrho-\varrho'}{g\text{D}} \times \frac{1}{d}.$$

By comparing this formula with the formula No. 2, it is obvious that water will rise to the same height between plates of glass as in a tube, provided the distance d between the two plates of glass is equal to r, or half the diameter of the tube. This result was obtained by Newton, and has been confirmed by the experiments of succeeding writers.

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Comparison of the formula with Gay-Lussac's experiments.

As the constant quantity $2\,\frac{2\varrho-\varrho'}{g\text{D}}$ is the same as already found for capillary tubes, we may take its value, viz. 15,1311, and substitute it in the preceding equation, we then have

$q = \frac{15.1311}{1.060}\,t = 14.1544$; and since

$h = q - \frac{d}{2}\left(1 - \frac{\pi}{2}\right)$, subtracting

$\frac{d}{2}\left(1 - \frac{\pi}{4}\right) = 0.1147$, we have

$h = 14.0397$, which differs very little from 13.574, the observed altitude.

It will be seen from the formula No. 2, that of all tubes that have a prismatic form, the hollow cylinder is the one in which the volume of fluid raised is the least possible, as it has the smallest perimeter. It appears, also, that if the section of the tube is a regular polygon, the altitudes of the fluid will be reciprocally proportional to the homologous lines of the similar base, a result which, as we have seen, M. Gellert obtained from direct experiment. Hence, in all prismatic tubes whose sections are polygons inscribed in the same circle, the fluid will rise to the same mean height. If one of the two bases is, for example, a square, and the other an equilateral triangle, the altitudes will be as $2 : 3\frac{3}{4}$, or very nearly as $7 : 8$.

Fluids may be in a state of stable and instable equilibrium in the same tube.

168. M. La Place has remarked, that there may be several states of equilibrium in the same tube, provided its width is not uniform. If we suppose two capillary tubes communicating with one another, so that the smallest is placed above the greatest, we may then conceive their diameters and lengths to be such, that the fluid is at first in equilibrium above its level in the widest tube, and that in pouring in some of the same fluid, so as to reach the smaller tube, and fill part of it, the fluid will still maintain itself in equilibrio. When the diameter of a capillary tube diminishes by insensible gradations, the different states of equilibrium are alternately stable and instable. At first the fluid tends to raise itself in the tube, and this tendency diminishing, becomes nothing in a state of equilibrium. Beyond this it becomes negative, and consequently the fluid tends to descend. Thus the first equilibrium is stable, since the fluid, being a little removed from this state, tends to return to it. In continuing to raise the fluid, its tendency to descend diminishes, and becomes nothing in the second state of equilibrium. Beyond this it becomes positive, and the fluid tends to rise, and consequently to remove from this state which is not stable. In a similar manner it will be seen, that the third state is stable, the fourth instable, and so on.

Connexion between the rise of fluids and the curvature of their surface.

169. Although the preceding method of considering the phenomena of capillary attraction is extremely simple and accurate, yet it does not indicate the connexion which subsists between the elevation and depression of the fluid, and the concavity or convexity of the surface which every fluid assumes in capillary spaces. The object of M. La Place's first method, contained in his first supplement, is to determine this connexion.

By means of the methods for calculating the attraction of spheroids, he determines the action of a mass of fluid terminated by a spherical surface, concave or convex, upon a column of fluid contained in an infinitely narrow canal, directed towards the centre of this surface. By this action La Place means the pressure which the fluid contained in the canal would exercise, in virtue of the attraction of its entire mass upon a plane base situated in the interior of the canal, and perpendicular to its sides, at any sensible distance from the surface, this base being taken for unity. He then shews that this action is smaller when the surface is concave than when it is plane, and greater when the surface is convex. The analytical expression of this action is composed of two terms. The first of these terms, which is much greater than the second, expresses the action of the mass terminated by a plane surface; and the second term expresses the part of the action due to the sphericity of the surface, or, in other words, the action of the meniscus comprehended between this surface and the plane which touches it. This action is either additive to the preceding, or subtractive from it, according as the surface is convex or concave. It is reciprocally proportional to the radius of the spherical surface; for the smaller that this radius is, the meniscus is the nearer to the point of contact.

From these results relative to bodies terminated by sensible segments of a spherical surface, La Place deduces this general theorem. "In all the laws which render the attraction insensible at sensible distances, the action of a body terminated by a curve surface upon an interior canal infinitely narrow, perpendicular to this surface in any point, is equal to the half sum of the actions upon the same canal of two spheres, which have for their radii the greatest and the smallest of the radii of the osculating circle of the surface at this point."

170. By means of this theorem, and the laws of hydrostatics, La Place has determined the figure which a mass of fluid ought to take when acted upon by gravity, or contained in a vessel of a given figure. The nature of the surface is expressed by an equation of partial differences of the second order, which cannot be integrated by any known method. If the figure of the surface is one of revolution, the equation is reduced to one of ordinary differences, and is capable of being integrated by approximation, when the surface is very small. La Place next shews, that a very narrow tube approaches the more to that of a spherical segment as the diameter of the tube becomes smaller. If these segments are similar in different tubes of the same substance, the radii of their surfaces will be inversely as the diameter of the tubes. This similarity of the spherical segments will appear evident, if we consider that the distance at which the action of the tube ceases to be sensible is imperceptible; so that if, by means of a very powerful microscope, this distance should be found equal to a millimetre, it is probable that the same magnifying power would give to the diameter of the tube an apparent diameter of several metres. The surface of the tube may therefore be considered as very nearly plane, in a radius equal to that of the sphere of sensible activity; the fluid in this interval will therefore descend, or rise from this surface, very nearly as if it were plane. Beyond this the fluid being subjected only to the action of gravity, and the mutual action of its own particles, the surface will be very nearly that of a spherical segment, of which the extreme planes being those of the fluid surface, at the limits of the sphere of the sensible activity of the tube, will be very nearly in different tubes equally inclined to their sides. Hence it follows that all the segments will be similar.

171. The approximation of these results gives the true cause of the ascent or descent of fluids in capillary tubes in the inverse ratio of their diameter. If in the axis of a glass tube we conceive a canal infinitely narrow, which bends

Fig. 56. round like the tube ABEDC in fig. 56, the action of the water in the tube in this narrow canal will be less, on account of the concavity of its surface, than the action of the water in the vessel on the same canal. The fluid will therefore rise in the tube to compensate for this difference of action; and as the concavity is inversely proportional to the diameter of the tube, the height of the fluid will be also inversely proportional to that diameter. If the surface of the interior fluid is convex, which is the case with mercury in a glass tube, the action of this fluid on the canal will be greater than that of the fluid in the vessel, and therefore the fluid will descend in the tube in the ratio of their difference, and consequently in the inverse ratio of the diameter of the tube.

In this manner of viewing the subject, the attraction of capillary tubes has no influence upon the ascent or depression of the fluids which they contain, but in determining the inclination of the first planes of the surface of the interior fluid extremely near the sides of the tube, and upon this inclination depends the concavity or convexity of the surface, and the length of its radius. The friction of the fluid against the sides of the tube may augment or diminish a little the curvature of its surface, of which we see frequent examples in the barometer. In this case the capillary effects will increase or diminish in the same ratio.

The differential equation of the surfaces of fluids inclosed in capillary spaces of revolution, conducts La Place to the following general result; that if into a cylindrical tube we introduce a cylinder which has the same axis as that of the tube, and which is such that the space comprehended between its surface and the interior surface of the tube has very little width, the fluid will rise in this space to the same height as in a tube whose radius is equal to this width. If we suppose the radii of the tube and of the cylinder infinite, we have the case of a tube included between two parallel and vertical planes, very near each other. This result has been confirmed, as we have already seen, by the experiments of Newton, Haüy, and Gay-Lussac. La Place then applies his theory to the phenomena presented by a drop of fluid, either in motion or suspended in equilibrio, either in a conical capillary tube, or between two plates, and inclined to each other, as discovered by Mr Hawksbee; to the mutual approximation of two parallel and vertical discs immersed in a fluid; to the phenomena which take place when two plates of glass are inclined to each other at a small angle; and to the determination of the figure of a large drop of mercury laid upon a horizontal plate of glass.

On the Form of Drops.

172. It was observed by M. Monge, that when drops of alcohol fall upon a surface of the same fluid, they do not at first mix with it, but roll over its surfaces with great facility, impinge against each other, and are reflected like billiard balls. M. Monge observed an analogous phenomenon in the drops of water which fall from the oars during the rowing of a boat, and during the condensation of the vapour of warm fluids.

In repeating the experiments of Monge, Sir David Brewster found that the phenomena were most beautiful when the capillary tube discharged the drops upon the inclined plane of fluid, which is elevated by the attraction of the edge of the cup. They ran down the inclined plane with great velocity, and sometimes even ascended the similar plane on the opposite side of the vessel. When the drop was discharged at the distance of one or two-tenths of an inch from the surface of the water, they had always the same magnitude when the tube was held in the same position; but when the point of the tube was brought within a tenth of an inch of the surface of the spirit of wine, this surface, instead of attracting the drop to it instantly, as Saussure would have predicted, actually resisted the gravity or weight of drop, and allowed it to attain a diameter nearly twice as great as it would have had, if it had been discharged in the ordinary manner. This swoln globule floated upon the surface in the same manner as the smaller drops, surrounded with a depression of the fluid surface similar to what is produced by a glass globule floating on mercury, or by the feet of particular insects, that have the power of running upon the surface of water. The floating

Capillary attraction, &c.

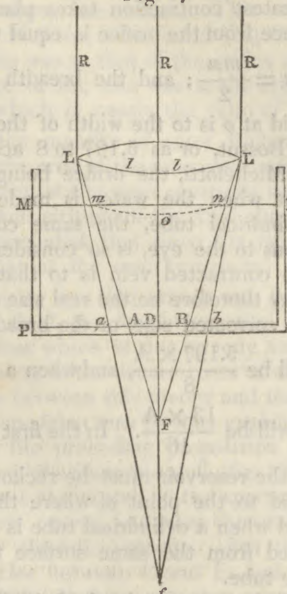
globules are often produced even when they are discharged from a height of three or four inches; and by letting them fall upon the inclined plane of fluid formerly mentioned, they will often rebound from the surface, and fall over the sides of the cup.

Opening in fluid film.

173. In a phenomenon the very reverse of the formation of a drop, which was first noticed by Sir David Brewster, the cohesion of fluids is shewn in a very interesting manner. If we take a phial, with a wide mouth, half filled with Canada balsam, and allow the balsam to flow to the mouth of the phial and fill it up, then when the phial is placed on its bottom, a fine transparent film of balsam will be seen extending over the mouth of the phial. If we now take a piece of slender wire, and touch the film near the middle, so as to tear away a little part of it, the remaining part of the film which has been elevated by this force will descend to its level position, and the ragged aperture from which the balsam has been torn will be seen to assume a form perfectly circular, having its edge in a slight degree thickened, like a circle with a raised margin turned out of a piece of wood. This fine circular aperture grows wider and wider, and continues to preserve its circular form till the mouth of the phial is again opened.

174. We shall now conclude the subject of capillary attraction with an account of an experiment made by Sir David Brewster, and intimately connected with the subject. Above a vessel MNOP, Fig. 57, nearly filled with water, a convex lens LL was placed at the distance of the 10th of an inch, and rays R, R, R, were incident upon its upper surface. The focus of these rays was at F, a little beyond the bottom of the vessel, so that a circular image of the luminous object was seen on the bottom of the vessel, having AB for its diameter. If the lens is now made to descend gradually towards the surface of the water, and the eye kept steadily upon the luminous image AB, a dark spot will be seen at D in the centre of AB, a little while before the lens attracts and elevates the water MN. Sometimes this spot may be seen playing backwards and forwards by the slight motion of the hand, so that the lens can even be withdrawn from the fluid surface without having actually touched it. In general, however, the sudden rise of the water to the lens follows the appearance of the black spot. When the water is in contact with the glass, the focus of the rays R, R, is now transferred to f, and the circular image on the bottom is now ab, and the intensity of the light in this circle is to that in the circle AB, as $AB^2 : ab^2$. Now it is obvious, that the darkish spot at D is just the commencement of the transference of the focus from F to f; or when the dark spot is produced, the progress of the rays is the same as if the focus were transferred to f. This remarkable effect may arise from two causes. 1. The approach of the lens to the surface MN, may occasion a depression mon in the surface of the fluid of the same curvature as LlL, which would have the effect of transferring the focus from F to f. 2. The transference of the focus from F to f may arise from the optical contact of the glass of water taking place at a greater distance from the lens than that at which capillary attraction commences.

Fig. 57.



PART II.—HYDRAULICS.

Definition.

175. Hydraulics is that branch of the science of Hydrodynamics which relates to fluids in motion. It comprehends the theory of running water, whether issuing from orifices in reservoirs by the pressure of the superincumbent mass, or rising perpendicularly in *jets d'eaux* from the pressure of the atmosphere; whether moving in pipes and canals, or rolling in the beds of rivers. It comprehends also the resistance or the percussion of fluids, and the oscillation of waves.

CHAPTER I.—THEORY OF FLUIDS ISSUING FROM ORIFICES IN RESERVOIRS, EITHER IN A LATERAL OR A VERTICAL DIRECTION.

Preliminary observations.

176. If water issues from an orifice either in the bottom or side of a reservoir, the surface of the fluid in the reservoir is always horizontal till it reaches within a little of the bottom. When a vessel, therefore, is emptying itself, the particles of the fluid descend in vertical lines, as is represented in fig. 58.; but when they have reached within three or four inches of the orifice mn, the particles which are not immediately above it change the direction of their motion, and make for the orifice in directions of different degrees of obliquity. The velocities of these particles may be decomposed into two others, one in a horizontal direction, by which they move parallel to the orifice, and the other in a vertical direction, by which they approach that orifice. Now, as the particles about C and D move with greater obliquity than those nearer E, their horizontal velocities must also be greater, and their vertical velocities less. But the particles near E move with so little obliquity that their vertical are much greater than their horizontal velocities, and very little less than their absolute ones. The different particles of the fluid, therefore, will rush through the orifice mn with very different velocities, and in various directions, and will arrive at a certain distance from the orifice in different times. On account of the mutual adhesion of the fluid particles, however, those which have the greatest velocity drag the rest along with them; and as the former move through the centre of the orifice, the breadth of the issuing column of fluid will be less at op than the width of the orifice mn.

Fig. 58.

Cause of the vena contracta

177. That the preceding phenomena really exist when a vessel of water is discharging its contents through an aperture, experience sufficiently testifies. If some small substances specifically heavier than water be thrown into the fluid when the vessel is emptying itself, they will at first descend vertically, and when they come within a few inches of the bottom they will deviate from this direction, and describe oblique curves similar to those in the figure.

Description of the vena contracta.

The contraction of the vein or column of fluid at op is also manifest from observation. It was first discovered by Sir Isaac Newton, and denominated the *vena contracta.* The greatest contraction takes place at a point o, whose distance from the orifice is equal to half its diameter, so that $om = \frac{mn}{2}$; and the breadth of the vein or column of fluid at o is to the width of the orifice as 5 to 8 according to Bossut, or as 5.197 to 8 according to the experiments of Michelotti, the orifice being perforated in a thin plate. But when the water is made to issue through a short cylindrical tube, the same contraction, though not obvious to the eye, is so considerable, that the diameter of the contracted vein is to that of the orifice as 6.5 to 8. If A therefore be the real size of the orifice in a thin plate, its corrected size, or the breadth of the contracted vein, will be $\frac{5.197 \times A}{8}$, and when a cylindrical tube is employed it will be $\frac{13 \times A}{16}$. In the first case the height of the water in the reservoir must be reckoned from the surface of the fluid to the point o, where the vein ceases to contract; and when a cylindrical tube is employed, it must be reckoned from the same surface to the exterior aperture of the tube.

Relation between the velocity of the fluid at the orifice, and that of the interior laminæ.

178. Suppose the fluid ABCD (fig. 58) divided into an infinite number of equal *strata* or *laminæ* by the horizontal surfaces MN, gh infinitely near each other; and let $mnop$ be a small column of fluid which issues from the orifice in the same time that the surface MN descends to gh. The column $mnop$ is evidently equal to the lamina MN gh, for the quantity of fluid which is discharged during the time that MN descends to gh, is evidently MN hg; and to the quantity discharged in that time, the column $mnop$ was equal by hypothesis. Let A be the area of the base MN, and B the area of the base mn; let x be the height of a column equal to MN gh, and having A for its base, and let y be the height of the column $mnop$. Then, since the column $mnop$ is equal to the lamina MN gh, we shall have $Ax = By$, and (Geometry, Sect. IV. Theor. IX.) $x : y = A : B$; but as the surface MN descends to gh in the same time that mn descends to op, x will represent the mean velocity of the lamina MN gh, and y the mean velocity of the column $mnop$. The preceding analogy, therefore, informs us, that the mean velocity of any lamina is to the velocity of the fluid issuing from the orifice reciprocally as the area of the orifice is to the area of the base of the lamina MN gh. Hence it follows, that, if the area of the orifice is infinitely small, with regard to the area of the base of the lamina into which the fluid is supposed to be divided, the mean velocity of the fluid at the orifice will be infinitely greater than that of the laminæ; that is, while the velocity at the orifice is finite, that of the laminæ will be infinitely small.

Fig. 58.

179. Before applying these principles to the theory of hydraulics, it may be proper to observe, that several distinguished philosophers have founded the science upon the same general law from which we have deduced the principles of hydrostatics (48). In this way they have represented the motion of fluids in general formulæ; but these formulæ are so complicated from the very nature of the theory, and the calculations are so intricate, and sometimes impracticable from their length, that they can afford no assistance to the practical engineer.

Definition.

Fig. 58.

180. If the water issues at mn with the same velocity V that a heavy body would acquire by falling freely through a given height H, this velocity is said to be due to the height H, and inversely the height H is said to be due to the velocity V.

Prop. I.

181. The velocity of a fluid issuing from an infinitely small orifice in the bottom or side of a vessel, is equal to that which is due to the height of the surface of the fluid above that orifice, the vessel being supposed constantly full.

Let AB, fig. 59, be the vessel containing the fluid, its velocity when issuing from the aperture mn will be that which is due to the height Dm, or equal to that which a heavy body would acquire by falling through that height. Because the orifice mn is infinitely small, the velocity of the laminæ into which the fluid may be supposed to be divided, will also be infinitely small. But since all the fluid particles, by virtue of their gravity, have a tendency to descend with the same velocity; and since the different laminæ of the fluid lose this velocity, the column $mnst$ must be pressed by the superincumbent column D mn; and calling S the specific gravity of the fluid, the moving force which pushes out the column $mnst$ will be $S \times Dm \times mn$ (art. 58). Now, let us suppose, that, when this moving force is pushing out the column $mnst$, the absolute weight of the column $mnop$, which may be represented by $S \times mn \times np$, causes itself to fall through the height np. Then, if V, U be the velocities impressed upon the columns $mnst$, and $mnop$, by the moving forces $S \times Dm \times mn$, and $S \times mn \times np$; these moving forces must be proportional to their effects, or to the quantities of motion which they produce, that is, to $V \times mnst$ and $U \times mnop$, because the quantity of motion is equal to the velocity and mass conjointly; hence we shall have $S \times Dm \times mn : S \times mn \times np = V \times mnst : U \times mnop$. But since the volumes $mnst$, $mnop$ are to one another as their heights mo, os, and as these heights are run through in equal times, and consequently represent the velocity of their motion, $mnst$ may be represented by $V \times mn$ and $mnop$ by $U \times mn$; therefore we shall have $S \times Dm \times mn : S \times mn \times np = V \times V \times mn : U \times U \times mn$, and dividing by mn, $S \times Dm : np = V^2 : U^2$. Now let v be the velocity due to the height Dm, then (see Mechanics) $np : U^2 = Dm : v^2$; but since $S \times Dm : S \times np = V^2 ; U^2$; then by (Euclid V. 15), and by permutation $Dm : V^2 = np : U^2$, therefore by substitution (Euclid V. 11), $Dm : V^2 = Dm : v^2$, and (Euclid V. 9), $V^2 = v^2$ or $V = v$. But V is the velocity with which the fluid issues from the orifice mn, and v the velocity due to the height Dm; therefore, since the velocities are equal, the proposition is demonstrated.

Fig. 59.

182. Cor. 1. If the vessel AB empties itself by the small orifice mn, so that the surface of the fluid takes successively the positions OP, QR, ST, the velocities with which the water will issue when the surfaces have these positions will be those due to the heights En, Fn, Gn, for in these different positions the moving forces are the columns Emn, Fmn, Gmn.

183. Cor. 2. Since the velocities of the issuing fluid when its surface is at E, F, G, are those due to the heights En, Fn, Gn, it follows from the properties of falling bodies (see Mechanics), that if these velocities were continued uniformly, the fluid would run through spaces equal to 2En, 2Fn, 2Gn respectively, in the same time that a heavy body would fall through En, Fn, Gn, respectively.

184. Cor. 3. As fluids press equally in all directions,

the preceding proposition will hold true, when the orifices are at the sides of vessels, and when they are formed to throw the fluid upwards, either in a vertical or an inclined direction, provided that the orifices are in these several cases at an equal distance from the upper surface of the fluid. This corollary holds also in the case mentioned in Cor. 1.

185. Cor. 4. When the fluid issues vertically, it will rise to a height equal to the perpendicular distance of the orifice from the surface of the fluid; for (see Mechanics), this is true of falling bodies in general, and must therefore be true in the case of water: owing to the resistance of the air, however, and the friction of the issuing fluid upon the sides of the orifice, jets of water do not exactly rise to this height.

186. Cor. 5. As the velocities of falling bodies are as the square roots of the heights through which they fall (see Mechanics), the velocity V of the effluent water when the surface is at E, will be to its velocity v when the surface is at G, as $\sqrt{\mathrm{E}n} : \sqrt{\mathrm{G}n}$, (Cor. 1.) that is, the velocities of fluids issuing from a very small orifice are as the square roots of the altitude of the water above these orifices. As the quantities of fluids discharged are as the velocities, they will also be as the square roots of the altitude of the fluid. This corollary holds true of fluids of different specific gravities, notwithstanding Belidor (*Architect. Hydraul.* tom. i. p. 187), has maintained the contrary; for though a column of mercury Dmn presses with 14 times the force of a similar column of water, yet the column $mnop$ (fig. 59) of mercury which is pushed out is also 14 times as heavy as a similar column of water; and as the resistance bears the same proportion to the moving force, the velocities must be equal.

187. Cor. 6. When a vessel is emptying itself, if the area of the laminæ into which we may suppose it divided, be everywhere the same, the velocity with which the surface of the fluid descends, and also the velocity of efflux, will be uniformly retarded. For as the velocity V with which the surface descends is to the velocity v at the orifice, as the area a of the orifice to the area A of the surface, then $\mathrm{V} : v = a : \mathrm{A}$; but the ratio of $a : \mathrm{A}$ is constant, therefore V varies as v, that is, $\mathrm{V} : \mathrm{V}' = v : v'$; but, (Cor. 1) $v : v' = \sqrt{h} : \sqrt{h'}$, h being the height of the surface above the orifice, therefore $\mathrm{V} : \mathrm{V}' = \sqrt{h} : \sqrt{h'}$. But this is the property of a body projected vertically from the earth's surface, and as the retarding force is uniform in the one case (see Mechanics), it must also be uniform in the other.

188. Cor. 7. If a cylindrical vessel be kept constantly full, twice the quantity contained in the vessel will run out during the time in which the vessel would have emptied itself. For (Cor. 2 and 6) the space through which the surface of the fluid at D would descend if its velocity continued uniform being 2 Dm, double of Dm the space which it actually describes in the time it empties itself, the quantity discharged in the former case will also be double the quantity discharged in the latter: because the quantity discharged when the vessel is kept full, may be measured by what the descent of the surface would be, if it could descend with its first velocity.

Scholium.

189. The reader will probably be surprised when he finds in some of our elementary works on hydrostatics, that the velocity of the water at the orifice is only equal to that which a heavy body would acquire by falling through *half* the height of the fluid above the orifice. This was first maintained by Sir Isaac Newton, who found that the diameter of the *vena contracta* was to that of the orifice as 21 to 25. The area therefore of the one was to the area of the other as 21^2 to 25^2, which is nearly the ratio of 1 to $\sqrt{2}$. But by measuring the quantity of water discharged in a given time, and also the area of the *vena contracta*, Sir Isaac found that the velocity at the *vena contracta* was that which was due to the *whole* altitude of the fluid above the orifice. He therefore concluded, that since the velocity at the orifice was to that at the *vena contracta*[1] as $1 : \sqrt{2}$, and in the latter velocity was that which was due to the whole altitude of the fluid, the former velocity, or that at the orifice, must be that which is due to only *half* that altitude, the velocities being as the square roots of the heights. Now the difference between this theory and that contained in the preceding proposition may be thus explained. The velocity found by the preceding proposition is evidently the vertical velocity of the filaments at E (fig. 59), which being immediately above the centre of the aperture mn are not diverted from their course, and have therefore their vertical equal to their absolute velocity. But the vertical velocity of the particles between C and E, and E and D, is much less than their absolute velocity, on account of the obliquity of their motion, and also on account of their friction on the sides of the orifice. The mean vertical velocity, consequently, of the issuing fluid will be much less than the vertical velocity of the particles at E, that is, than the velocity found by the above proposition, or that due to the height Dm. Now the velocity found by Sir Isaac Newton from measuring the quantity of water discharged, was evidently the mean velocity, which ought to be less than the velocity given by the preceding proposition, the two velocities being as $1 : \sqrt{2}$, or as $1 : 1.414$. The theorem of Newton therefore may be considered as giving the mean velocity at the orifice, while the proposition gives the velocity of the particles at D, or the velocity at the *vena contracta*.

Prop. II.

190. To find the quantity of water discharged from a very small orifice in the side or bottom of a reservoir, the time of discharge, and the altitude of the fluid, the vessel being kept constantly full, and any two of these quantities being given.

Let A be the area of the orifice mn; W the quantity of water discharged in the time T; H the constant height Dm of the water in the vessel, and let 16.087 feet be the height through which a heavy body descends in a second of time. Now, as the times of description are proportional to the square roots of the heights described, the time in which a heavy body will fall through the height H, will be found from the following analogy; $\sqrt{16.087} : \sqrt{\mathrm{H}} = 1 : \frac{\sqrt{\mathrm{H}}}{16.087}$, the time required. But as the velocity at the orifice is uniform, a column of fluid whose base is mn and altitude 2H (Prop. I. Cor. 2.) will issue in the time 16.087 $\sqrt{\mathrm{H}}$, or since A is the area of the orifice mn, $\mathrm{A} \times 2\mathrm{H}$ or

[1] When a fluid runs through a conical tube kept constantly full, the velocities of the fluid in different sections will be inversely as the area of the sections. For as the same quantity of fluid runs through every section in the same time, it is evident that the velocity must be greater in a smaller section, and as much greater as the section is smaller, otherwise the same quantity of water would not pass through each section in the same time. Now the area of the *vena contracta* is to the area of the orifice, as $1 : \sqrt{2}$, therefore the velocity at the *vena contracta* must be to the velocity at the orifice as $\sqrt{2} : 1$.

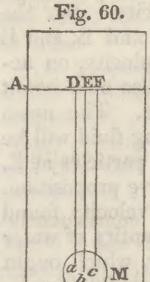
2HA will represent the column of fluid discharged in that time. Now since the quantities of fluid discharged in different times must be as the times of discharge, the velocity at the orifice being always the same, we shall have $\frac{\sqrt{H}}{16.087}:T = 2HA : W$, and (GEOMETRY, Sect. IV. Theor. VIII.) $\frac{W\sqrt{H}}{16.087} = 2HAT$ or $W = \frac{2HAT \times 16.087}{\sqrt{H}}$, and since $\frac{H}{\sqrt{H}} = \sqrt{H}$ we shall have $W = 2AT\sqrt{H} \times 16.087$, an equation from which we deduce the following formulæ, which determine the quantity of water discharged, the time of discharge, the altitude of the fluid, and the area of the orifice, any three of these four quantities being given:

$$W = 2AT\sqrt{H \times 16.087} \qquad A = \frac{W}{2T\sqrt{H \times 16.087}}$$

$$H = \frac{W^2}{4A^2T^2 \times 16.087} \qquad T = \frac{W}{2A\sqrt{H = 16.087}}$$

191. It is supposed in the preceding proposition that the orifice in the side of the vessel is so small, that every part of it is equally distant from the surface of the fluid. But when the orifice is large like M (fig. 60.), the depths of different parts of the orifice below the surface of the fluid are very different, and consequently the preceding formulæ will not give very accurate results. If we suppose the orifice M divided into a number of smaller orifices a, b, c, it is evident that the water will issue at a, with a velocity due to the height Da, the water at b, with a velocity due to the height Eb, and the water at c, with a velocity due to the height Fc. When the whole orifice, therefore, is opened, the fluid will issue with different velocities at different parts of its section. Consequently, in order to find new formulæ expressing the quantity of water discharged, we must conceive the orifice to be divided into an infinite number of areas or portions by horizontal planes; and by considering each area as an orifice, and finding the quantity which it will discharge in a given time, the sum of all these quantities will be the quantity discharged by the whole orifice M.

Fig. 60.



Prop. III.

192. To find the quantity of water discharged by a rectangular orifice in the side of a vessel kept constantly full.

Let ABD (fig. 61.) be the vessel with the rectangular orifice GL, and let AB be the surface of the fluid. Draw the lines MNOP, $mnop$, infinitely near each other, and from any point D draw the perpendicular DC meeting the surface of the fluid in C. Then regarding the infinitely small rectangle MO mo as an orifice whose depth below the surface of the fluid is H, we shall have by the first of the preceding formulæ, the quantity of water discharged in the time T, or $W = T\sqrt{16.087} \times \sqrt{CN} \times \overline{2MO \times Nn}$, CN being equal to H and $MO \times Nn$ to the area A. As the preceding formula represents the quantity of fluid discharged by each elementary rectangular orifice, into which the whole orifice GL is supposed to be divided, we must find the sum of all the quantities discharged in the time T, in order to have the total quantity afforded by the finite orifice in the same time. Upon DC as the principal axis, describe the parabola CHE, having its parameter P equal to 4DC. Continue FG and DK to H and E. The area NPpn may be expressed by $NP \times Nn$. But (CONIC SECTIONS, Part I. Prop. X.) $\overline{NP}^2 = CN \times P$ (P being the parameter of the parabola), therefore $NP = \sqrt{CN \times P}$, and multiplying by Nn we have $NP \times Nn = Nn\sqrt{CN \times P}$, which expresses the area NPpn. Now this expression of the elementary area being multiplied by the constant quantity $T\sqrt{16.087} \times \frac{MO}{\sqrt{\frac{1}{4}P}}$ gives for a product $T\sqrt{16.087} \times \sqrt{CN} \times \overline{2MO \times Nn}$, for $\sqrt{\frac{1}{4}P} = \frac{1}{2}\sqrt{P}$ and $\frac{MO \times \sqrt{P}}{\frac{1}{2}\sqrt{P}} = 2MO$. But this product is the very same formula which expresses the quantity of water discharged in the time T by the orifice MO om. Therefore, since the elementary area MPpm multiplied by the constant quantity $T\sqrt{16.087} \times \frac{MO}{\sqrt{\frac{1}{4}P}}$ gives the quantity of water discharged by the orifice MO om in a given time, and since the same may be proved of every other orifice of the same kind into which the whole orifice is supposed to be divided, we may conclude that the quantity of water discharged by the whole orifice GL will be found by multiplying the parabolic area FHED by the same constant quantity $T\sqrt{16.087} \times \frac{MO}{\sqrt{\frac{1}{4}P}}$. Now the area FHED is equal to the difference between the areas CDE and CFH. But (CONIC SECTIONS, Part I. Prop. X.) the area $CDE = \frac{2}{3}CD \times DE$; and since $P = 4CD$, and (CONIC SECTIONS, Part I. Prop. X.) $\overline{DE}^2 = CD \times P$ we have $\overline{DE}^2 = CD \times 4CD = 4CD^2$, that is $DE = 2CD$, then by substituting this value of DE in the expression of the area CDE, we have $CDE = \frac{4}{3}CD^2$. The area $CFH = \frac{2}{3}CF \times FH$, consequently the area $FHED = \frac{4}{3}CD^2 - \frac{2}{3}CF \times FH$, which, multiplied by the constant quantity, gives for the quantity of water discharged, ($\frac{1}{3}P^2$ being substituted instead of its equal $\frac{4}{3}CD^2$),

$$W = \frac{T\sqrt{16.087} \times MO \times \overline{\frac{1}{3}P^2 - \frac{2}{3}CF \times FH}}{\sqrt{\frac{1}{4}P}}.$$

But by the property of the parabola $FH^2 = CF \times P$ and $FH = \sqrt{CF \times P}$, therefore substituting this value of FH in the preceding formula, and also $\frac{1}{2}\sqrt{P}$ for its equal $\sqrt{\frac{1}{4}P}$ we have

$$W = \frac{T\sqrt{16.087} \times MO \times \overline{\frac{1}{3}P^2 - \frac{2}{3}CF \times \sqrt{CF \times P}}}{\frac{1}{2}\sqrt{P}}$$

and dividing by $\frac{1}{2}\sqrt{P}$ gives us

$$W = T\sqrt{16.087} \times MO \times \overline{\frac{2}{3}P\sqrt{P} - \frac{4}{3}CF \times \sqrt{CF}};$$

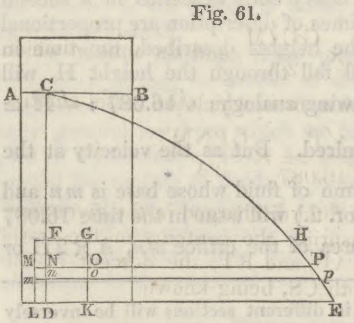
hence

$$T = \frac{W}{\sqrt{16.087} \times MO \times \frac{2}{3}P\sqrt{P} - \frac{4}{3}CF \times \sqrt{CF}},$$

$$MO = \frac{W}{T\sqrt{16.087} \times \frac{2}{3}P\sqrt{P} - \frac{4}{3}CF \times \sqrt{CF}},$$

$$P = \left[\frac{9W}{4T\sqrt{16.087}} + 3CF\sqrt{CF}\right]^{\frac{2}{3}},$$

Fig. 61.



and since P = 4CD

$$CD = \overline{\frac{9W}{16T\sqrt{16.087}} + 12CF \times \sqrt{CF}}\Big|^{\frac{2}{3}},$$

$$CF = \overline{\frac{9W}{16T\sqrt{16.087}} + \tfrac{1}{8}P\sqrt{P}}\Big|^{\frac{2}{3}}.$$

In these formulæ W represents the quantity of water discharged, T the time of discharge, MO the horizontal width of the rectangular orifice, P the parameter of the parabola = 4CD, CD the depth of the water in the vessel or the altitude of the water above the bottom of the orifice, and CF the altitude of the water above the top of the orifice. The vertical breadth of the orifice is equal to CD — CF.

193. Let x be the mean height of the fluid above the orifice, or the height due to a velocity, which, if communicated to all the particles of the issuing fluid, would make the same quantity of water issue in the time T, as if all the particles moved with the different velocities due to their different depths below the surface, then by Prop. II. the quantity discharged or $W = 2T \times MO \times \overline{CD - CF} \times \sqrt{x \times 16.087}$, the area of the orifice being $MO \times \overline{CD - CF}$, and by making this value of W equal to its value in the preceding article, we have the following equation:

$2T \times MO \times \overline{CD - CF} \times \sqrt{x \times 16.087} = T\sqrt{16.087} \times MO \times \overline{\tfrac{2}{3}P\sqrt{P} - \tfrac{4}{3}CF\sqrt{CF}}$, which, by division and reduction, and the substitution of $\tfrac{1}{4}P$ instead of CD its equal, becomes

$$x = \frac{\tfrac{4}{9}(P\sqrt{P} - \tfrac{4}{3}CF\sqrt{CF})^2}{4(\tfrac{1}{4}P - CF)^2}.$$

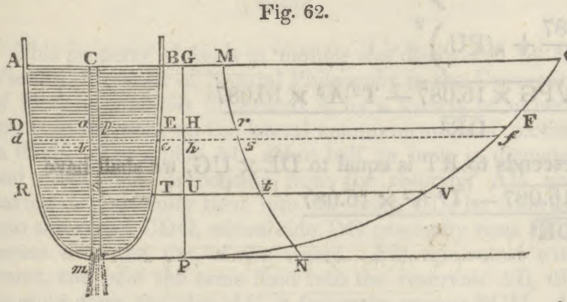
Now this value of x is evidently different from the distance of the centre of gravity of the orifice from the surface of the fluid, for this distance is $\frac{CD + CF}{2}$ or $\frac{\tfrac{1}{4}P + CF}{2}$. But in proportion as CE increases, the other quantities remaining the same, the value of x will approach nearer the distance of the centre of gravity of the orifice from the surface of the fluid; for when CF becomes infinite, the parabolic arch CHE will become a straight line, and consequently the mean ordinate of the curve, which is represented by the mean velocity of the water, will pass through the middle of FD or the centre of gravity of the orifice.

Prop. IV.

194. To find the time in which a quantity of fluid equal to ABRT, will issue out of a small orifice in the side or bottom of the vessel AB, that is, the time in which the surface AB will descend to RT.

Draw DE, de at an infinitely small distance, and parallel to AB. The lamina of fluid DdeE may be represent-

Fig. 62.



ed by $DE \times ob$; DE expressing the area of the surface. When the surface of the water has descended to DE, the quantity of fluid which will be discharged by an uniform velocity in the time T, will be $T\sqrt{16.087} \times 2A \times \sqrt{om}$, A being the area of the orifice, as in Prop. II. But as the variation in the velocity of the water will be infinitely small, when the surface descends from DE to de, its velocity may be regarded as uniform. The time, therefore, in which the surface describes the small height ob will be found by the following analogy; $T\sqrt{16.087} \times 2A \times \sqrt{om}$: $T = DE \times ob : \frac{DE \times ob}{\sqrt{16.087} \times 2A \times \sqrt{om}}$. Now as this formula expresses the time in which the surface descends from DE to de, and as the same may be shewn of every other elementary portion of the height CS, the sum of all these elementary times will give us the value of T, the time in which the surface AB falls down to RT. For this purpose draw GP equal and parallel to Cn, and upon it as an axis, describe the parabola PVQ, having its parameter P equal to 4GP. Continue the lines AB, DE, de, RT, so as to form the ordinates HF, hf, UV, of the parabola. Upon GP as an axis, describe a second curve, so that the ordinate GM may be equal to the area of the surface at AB, divided by the corresponding ordinate GQ of the parabola, and that the ordinate Hr may be the quotient of the area of the surface at DE divided by the ordinate HF. Now (Conic Sections, Part I. Prop. X.) $\overline{HF}^2 = HP \times P$, or $HF = \sqrt{HP} \times \sqrt{P}$, that is $\sqrt{HP} = \frac{HF}{\sqrt{P}}$, and since $om = HP$; $\frac{DE}{\sqrt{om}} = \frac{DE \times \sqrt{P}}{HF}$. But by the construction of the curve MN, we have $\frac{DE}{HF} = Hr$, consequently $\frac{DE}{\sqrt{om}} = Hr \times \sqrt{P}$. The elementary time, therefore, expressed by $\frac{DE \times ob}{\sqrt{16.087} \times 2A \times \sqrt{om}}$ will, by the different substitutions now mentioned, be $\frac{\overline{Hr \times ob}\sqrt{P}}{2A\sqrt{16.087}}$ or $\frac{\sqrt{P}}{2A\sqrt{16.087}} \times Hr \times ob$. But the factor $\frac{\sqrt{P}}{2A\sqrt{16.087}}$ consisting of constant quantities is itself constant, and the other factor $Hr \times ob$ represents the variable curvilineal area Hrsh. Now as the same may be shewn of every other element of the time T, compared with the corresponding elements of the area GUtM, it follows that the time T required, will be found by multiplying the constant quantity $\frac{\sqrt{P}}{2A\sqrt{16.087}}$ by the curvilineal area GUtM; therefore $T = \frac{\sqrt{P}}{\sqrt{16.087}} \times \frac{GUtM}{2A}$, and the time in which the surface descends to mn, or in which the vessel empties itself, will be equal to $\frac{\sqrt{P}}{\sqrt{16.087}} \times \frac{GPNM}{2A}$.

Cor. The quantity of fluid discharged in the given time T may be found by measuring the contents of the vessel AB between the planes AB, and RT, the descent of the surface AB, viz. the depth CS, being known.

Prop. V.

195. To find the time in which a quantity of fluid equal to

Motion of Fluids, &c.

ABRT will issue out of a small orifice in the side or bottom of the *cylindrical* vessel AB, that is, the time in which the surface AB will descend to RT.

Let us suppose that a body ascends through the height mC (fig. 63.) with a velocity increasing in the same manner as if the vessel AB were inverted, and the body fell from m to C. The velocity of the ascending body at different points of its path being proportional to the square roots of the heights described, will be expressed by the ordinates of the parabola PVQ. The line DE being infinitely near to de, as soon as the body arrives at b it will describe the small space bo or hH in a portion of time infinitely small, with a velocity represented by the ordinate HF. Now the time in which the body will ascend through the space mC or its equal PG will be $\frac{\sqrt{PG}}{\sqrt{16.087}}$, because $\sqrt{16.087} : \sqrt{PG} = \frac{\sqrt{PG}}{\sqrt{16.087}}$ (see MECHANICS); and if the velocity impressed upon the body when at C were continued uniformly, it would run through a space equal to 2GP or GQ in the time $\frac{\sqrt{PG}}{\sqrt{16.087}}$. But (DYNAMICS, 22.) the times of description are as the spaces described directly, and the velocities inversely, and therefore the time of describing the space 2GP or GQ uniformly, viz. the time $\frac{\sqrt{PG}}{\sqrt{16.087}}$ will be to the time of describing the space hH uniformly as $\frac{GQ}{GQ} : \frac{Hh}{HF}$, that is, as $\frac{GQ}{GQ}$ or $1 : \frac{\sqrt{PG}}{\sqrt{16.087}} = \frac{Hh}{HF} : \frac{\sqrt{PG}}{\sqrt{16.087}} \times \frac{Hh}{HF}$ the time in which the ascending body will describe Hh uniformly; but PG being equal to $\frac{1}{4}$P, the parameter of the parabola, we shall have $\sqrt{PG} = \sqrt{\tfrac{1}{4}P} = \tfrac{1}{2}\sqrt{P}$. Substituting this value of $\sqrt{PG}$ in the last formula, we shall have for the expression of the time of describing Hh uniformly $\frac{\frac{1}{2}\sqrt{P}}{\sqrt{16.087}} \times \frac{Hh}{HF}$. But by Prop. IV. the time in which the surface DH descends into the position dh, that is, in which it describes Hh is represented by $\frac{\sqrt{P}}{2A\sqrt{16.087}} \times Hr \times ob$ or $\frac{\sqrt{P}}{\sqrt{16.087}} \times \frac{Hr \times Hh}{2A}$. Therefore the time in which the ascending body moves through hH, is to the time in which the descending surface moves through Hh as $\frac{\frac{1}{2}\sqrt{P}}{\sqrt{16.087}} \times \frac{Hh}{HF} : \frac{\sqrt{P}}{\sqrt{1.6087}} \times \frac{Hr \times Hh}{2A}$, which expressions, after being multiplied by 2, and after substituting in the latter $\frac{DE}{HF}$ instead of Hr, which is equal to it by construction, will become $\frac{\sqrt{P}}{\sqrt{16.087}} \times \frac{Hh}{HF} : \frac{\sqrt{P}}{\sqrt{16.087}} \times \frac{DE \times Hh}{A \times HF}$, DE representing, in this and in the following proposition, the area of the surface of the fluid at D. Now, if we multiply the first of these expressions by DE, and the second by A, we shall find the two products equal; consequently (Euclid VI. 16.), the first expression is to the second, or the time of the body's ascent through hH is to the time of the surface's descent through Hh, as the area A of the orifice is to the area DE of the base of the cylindrical vessel; and as the same may be demonstrated of every elementary time in which the ascending body and the descending surface describe equal spaces, it follows that the whole time in which the ascending body will describe the height mC or PG, is to the whole time in which the surface AB will descend to mn, or in which the vessel will empty itself, as the area A of the orifice is to the area of the surface DE, that is, $A : DE = \sqrt{\frac{PG}{16.087}} : \sqrt{\frac{PG}{16.087}} \times \frac{DE}{A}$, the time in which the vessel AB will empty itself. If RTmn be the vessel, it may be shewn in the same manner, that the time in which it will empty itself will be $\sqrt{\frac{PU}{16.087}} \times \frac{DE}{A}$, DE being equal to RT. But the difference between the times in which the vessel ABmn empties itself, and the time in which the vessel RTmn empties itself, will be equal to the time required in the proposition, during which the surface AB descends to RT. This time therefore will be

$$T = \sqrt{\frac{PG}{16.087}} \times \frac{DE}{A} \sqrt{\frac{PU}{16.087}} \times \frac{DE}{A} = \frac{DE\sqrt{PG} - DE\sqrt{PU}}{A\sqrt{16.087}}$$

$$T = \frac{DE \times \overline{\sqrt{PG} - \sqrt{PU}}}{A\sqrt{16.087}}. \text{ Hence}$$

$$PU = \left(\frac{T,\ A\sqrt{16.087}}{DE} - \sqrt{PG}\right)^2$$

$$PG = \left(\frac{T,\ A\sqrt{16.087}}{DE} + \sqrt{PU}\right)^2$$

$$PG - PU \text{ or } UG = \frac{2T,\ A \times DE\sqrt{PG \times 16.087} - T^2 A^2 \times 16.087}{\overline{DE}^2}$$

As the quantity of fluid discharged while the surface AB descends to RT is equal to DE $\times$ UG, we shall have

$$W = DE \times \frac{2T,\ A \times DE\sqrt{PG \times 16.087} - T^2 A^2 \times 16.087}{\overline{DE}^2}$$

$$A = \frac{\overline{DE} \times \sqrt{PG} \times \sqrt{PU}}{T\sqrt{16.087}}$$

$$DE = \frac{T,\ A\sqrt{16.087}}{\sqrt{PG} - \sqrt{PU}}.$$

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Prop. VI.

196. If two cylindrical vessels are filled with water, the time in which their surfaces will descend through similar heights will be in the compound ratio of their bases, and the difference between the square roots of the altitudes of each surface at the beginning and end of its motion, directly, and the area of the orifices inversely.

Figs. 63 and 64.

Let AB mn, A′B′ $m'n'$ be the two vessels; then by the

Fig. 63.

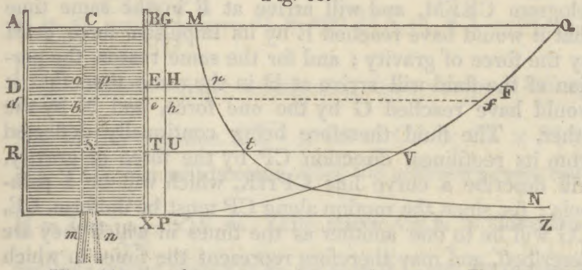
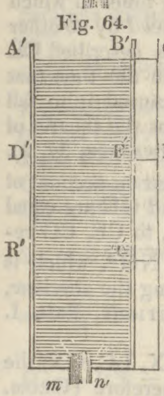


Fig. 64.



last proposition, the time T, in which the surface AB of the first descends to RT, will be to the time T′ in which the surface A′B′ of the second descends to R′T′ as $\frac{DE \times \sqrt{PG} \times \sqrt{PU}}{A\sqrt{16.087}}$ to $\frac{D'E' \times \sqrt{P'G'} - \sqrt{P'U'}}{A' \sqrt{16.087}}$, or by dividing by $\sqrt{16.087}$, as $\frac{DE \times \sqrt{PG} - \sqrt{PU}}{A}$ to $\frac{D'E' \times \sqrt{PG} - \sqrt{PU}}{A}$. Q.E.D.

197. Cor. Hence the time in which two cylindrical vessels full of water will empty themselves, will be in the compound ratio of their bases and the square roots of their altitudes directly, and the area of the orifices inversely; for in this time the surfaces AB, A′B′ descend to mn, $m'n'$ respectively, and therefore $\sqrt{PG} - PU = \sqrt{PG}$; since PU vanishes, the times will be as $\frac{DE \times \sqrt{PG}}{A}$ to $\frac{D'E' \times \sqrt{P'G'}}{A}$.

Prop. VII.

198. To explain the theory and construction of clepsydræ or water-clocks. Theory of clepsydræ or water-clocks.

A clepsydra, or water-clock, is a machine which, filled with water, measures time by the descent of the fluid surface. See Part III. on *Hydraulic Machinery*.

It has already been demonstrated in Prop. IV. that the times in which the surface AB descends to DE and RT, &c. are as the areas GM r H, GM t U, &c. If such a form therefore is given to the vessel that the areas GM r H, GM t U, &c. increase uniformly as the times, or are to one another as the numbers 1, 2, 3, 4, 5, &c. the times in which the surface AB descends to DE, and RT, &c. will be in the same ratio, and the vessel will form a machine for measuring time. If the vessel is cylindrical and empties itself in 12 hours, its altitude may be divided in such a manner that the fluid surface may take exactly an hour to descend through each division. Let the cylindrical vessel, for example, be divided into 144 equal parts, then the surface of the water, when the twelve hours begin to run, will be 144 parts above the bottom of the vessel; when one hour is completed, the surface will be 121 parts above the bottom and so on in the following manner:

Hours.	0	1	2	3	4	5	6	7	8	9	10	11	12
Distance of each Hour above the bottom.	144	121	100	81	64	49	36	25	16	9	4	1	0
Number of Parts in each Hour.	23	21	19	17	15	13	11	9	7	5	3	1	

For since the velocity with which the surface AB descends, the area of that surface being always the same, is as the square roots of its altitude above the orifice (Prop. I. Cor. 6); and since the velocities are as the times of description, the times will also be as the square roots of the altitudes, that is, when

12 11 10 9 &c. are the times,
144 121 100 81 will be the altitudes of the surface.

Prop. VIII.

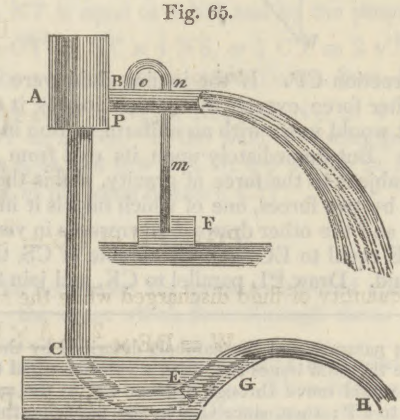
199. To explain the lateral communication of motion in fluids.

Lateral communication of motion in fluids.

This property of fluids in motion was discovered by M. Venturi, Professor of Natural Philosophy in the University of Modena, who has illustrated it by a variety of experiments in his work on the lateral communication of motion in fluids. Let a pipe AC, about half an inch in diameter and a foot long, proceeding from the reservoir AB, and having its extremity bent into the form CD, be inserted into the vessel CDG, whose side DG gradually rises till it passes over the rim of the vessel. Fill this vessel with water, and pour the same fluid into the reservoir AB, till, running down the pipe AC, it forms the stream EGH. In a short while, the water in the vessel CDG will be carried off by the current EG, which communicates its motion to the adjacent fluid. In the same way, when a stream of water runs through air, it drags the air along with it, and produces wind. Hence we have the water blowing machine, which conveys a blast to furnaces, and which will be described in a future part of this article. The lateral communication of motion, whether the surrounding fluid be air or water, is well illustrated by the following beauti-

Water blowing machine.

Fig. 65.



ful experiments of Venturi's. In the side of the reservoir AB (fig. 65), insert the horizontal pipe P about an inch and a half in diameter, and five inches long. At the point o of this pipe, about seven-tenths of an inch from the reservoir, fasten the bent glass tube $o\,n\,m$, whose cavity communicates with that of the pipe, whilst its other extremity is immersed in coloured water contained in the small vessel F. When water is poured into the reservoir AB, having no connection with the pipe C, so that it may issue from the horizontal pipe, the red liquor will rise towards m in the incurvated tube $o\,n\,m$. If the descending leg of this glass syphon be six inches and a half longer than the other, the red liquor will rise to the very top of the syphon, enter the pipe P, and running out with the other water, will in a short time leave the vessel F empty. Now, the cause of this phenomenon is evidently this: When the water begins to flow from the pipe P, it communicates with the air in the syphon $o\,n\,m$, and drags a portion along with it. The air in the syphon is therefore rarefied, and this process of rarefaction is constantly going on as long as the water runs through the horizontal pipe. The equilibrium between the external air pressing upon the fluid in the vessel F, and that included in the syphon, being thus destroyed, the red liquor will rise in the syphon, till it communicates with the issuing fluid, and is dragged along with it through the orifice of the pipe P, till the vessel F is emptied.

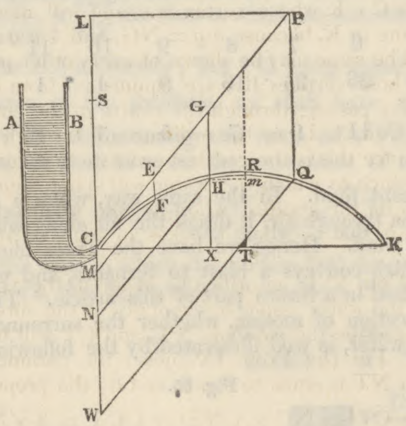
Prop. IX.

200. To find the horizontal distance to which fluids will spout from an orifice perforated in the side of a vessel, and the curve which it will describe.

Theory of vertical and oblique jets.

Let AB be a vessel filled with water, and C an orifice in its side, so inclined to the horizon as to discharge the fluid

Fig. 66.



in the direction CP. If the issuing fluid were influenced by no other force except that which impels it out of the orifice, it would move with an uniform motion in the direction CP. But immediately upon its exit from the orifice C, it is subject to the force of gravity, and is therefore influenced by two forces, one of which impels it in the direction CP, and the other draws it downwards in vertical lines. Make CE equal to EG, and CP double of CS, the altitude of the fluid. Draw PL parallel to CK, and join SL. Draw also EF, GH parallel to CN, and FM, HN parallel to CG, and let CM, CN represent the force of gravity, or the spaces through which it would cause a portion of fluid to descend in the time that this portion would move through CE, CG respectively, by virtue of the impulsive force. Now, it follows from the composition of forces (Dynamics, 135), that the fluid at C, being solicited in the direction CE by a force which would carry it through CE in the same time that the force of gravity would make it fall through CM, will describe the diagonal CF of the parallelogram CEFM, and will arrive at F in the same time that it would have reached E by its impulsive force, or M by the force of gravity; and for the same reason the portion of the fluid will arrive at H in the same time that it would have reached G by the one force, and N by the other. The fluid therefore being continually deflected from its rectilineal direction CP by the force of gravity, will describe a curve line CFHK, which will be a parabola; for since the motion along CP must be uniform, CE, CG will be to one another as the times in which they are described, and may therefore represent the times in which the fluid would arrive at E and G, if influenced by no other force. But in the time that the fluid has described CE gravity has made it fall through EF, and in the time that it would have described CG, gravity has caused it to fall through GH. Now, since the spaces are as the squares of the times in which they are described (Dynamics, 37, 2), we shall have $EF : GH = \overline{CE}^2 : \overline{CG}^2$. But on account of the parallelograms CEFM, CGHN, EF and GH are equal to CM and CN respectively, and MF, NH, to CE, CG respectively; therefore $CM : CN = \overline{MF}^2 : \overline{NH}^2$, which is the property of the parabola, CM, CN being the abscissæ, and MF, NH the ordinates (Conic Sections, Part. I. Prop. IX. Cor.).

201. On account of the parallels LP, CX, LC, GX, the triangles LCP, GCX are similar, and therefore (Geom. Sect. IV. Theor. XX.) $CG : CX = PC : PL$ and $GX : CX = CL : PL$. Hence $CG = \frac{CX \times PC}{PL}$, and $GX = \frac{CX \times CL}{PL}$, but since $PC = 2\,CS$, we have $CG = \frac{CX \times 2\,CS}{PL}$, and since $GX = GX - HX$, we shall have $GH = \frac{CX \times CL}{PL} - HX$. But as the parameter of the parabola CRK is equal to 4 CS (1), we have, by the property of this conic section, $\overline{NH}^2 = CN \times 4\,CS$, or $\overline{CG}^2 = 4\,\overline{GH} \times CS$; therefore, by substituting in this equation the preceding values of CG and GH, we shall have $\overline{CX}^2 \times CS = CX \times CL \times PL - HX \times \overline{PL}^2$. Now, it is evident, from this equation, that HX is nothing, or vanishes when $CX = 0$, or when $CX = \frac{CL \times PL}{CS}$, for HX being $= 0$, $HX \times \overline{PL}^2$, will also be $= 0$, and the equation will become $\overline{CX}^2 \times CS = CX \times CL \times PL$, or dividing by CX and CS, it becomes $CX = \frac{CL \times PL}{CS}$. But,

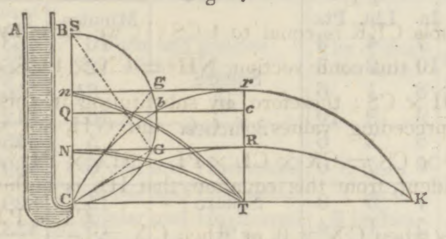
(1) The parameter of the parabola described by the issuing fluid, is equal to *four times* the altitude of the fluid above the orifice. For, since the fluid issues at C with a velocity equal to that acquired by falling through SC, if this velocity were continued uniform, the fluid would move through 2 CS or CP, in the same time that a heavy body would fall through SC. Draw PQ parallel to CS, and QW to CP; then, since Q is in the parabola, the fluid will describe CP uniformly in the same time that it falls through CW by the force of gravity, therefore $CW = CS$. Now $CP = 2\,CS$, and $\overline{CP}^2 = 4\,\overline{CS}^2 = 4 \times CS \times CS = 4 \times CS \times CW$; but it is a property of the parabola, that the square of the ordinate WQ or CP is equal to the product of the abscissa CW and the parameter, therefore 4 CS is the parameter of the parabola.

Motion of Fluids, &c.

when HX vanishes towards K, CX is equal to CK, consequently $CK = \frac{CL \times PL}{CS}$. Bisect CK in T, then $CT = \frac{CK}{2}$, and $CT = \frac{CL \times PL}{2\ CS}$. Draw TR perpendicular to CK, and TR will be found $= \frac{\overline{CL}^2}{4\ CS}$. Then, if H m be drawn at right angles to HX, we shall have $CX = CT - Hm = \frac{CL \times PL}{2\ CS} - Hm$ and $HX = RT - R = \frac{\overline{CL}^2}{4\ CS} - Rm$. After substituting these values of CX and HX in the equation $\overline{CX}^2 \times CS = CX \times CL \times PL - HX \times \overline{PL}^2$, it will become, after the necessary reductions, $\overline{Hm}^2 = \frac{PL^2}{CS} \times Rm$. The curve CRK is therefore a parabola whose vertex is R, its axis RT, and its parameter $\frac{\overline{PL}^2}{CS}$, R m being an abscissa of the axis, and H m its corresponding ordinate. Now, making a = CS, the altitude of the reservoir; R = radius; m = PL the sine of the angle PCL; and n = CL, the cosine of the same angle, CP being radius. Then CP : PL = R : m, therefore $PL \times R = CP \times m$, and dividing by R and substituting $2\,a$ or 2 CS, instead of its equal CP, we have $PL = \frac{2\,a\,m}{R}$, and by the very same reasoning, we have $CL = \frac{2\,a\,n}{R}$. Hence $RT = \frac{\overline{CL}^2}{4\ CS}$ will be $= \frac{4\,a^2\,n^2}{R^2}$ divided by $4\,a$, or $RT = a \times \frac{n^2}{R^2}$, and $CT = \frac{CL \times PL}{2\ CS} = \frac{4\,a^2\,m\,n}{2\,a \times R^2} = 2\,a \times \frac{m\,n}{R^2}$, and the parameter of the parabola $= \frac{PL^2}{CS} = \frac{4\,a^2\,m^2}{a \times R^2} = 4\,a \times \frac{m^2}{R^2}$.

202. Hence we have the following construction. With $\frac{1}{2}$ CS as radius, describe the semicircle SGC, which the

Fig. 67.



direction CR of the jet or issuing fluid meets in G. Draw GN perpendicularly to CS, and having prolonged it towards R, make GR equal to GN. From R let fall RT perpendicular to CK, and meeting it in T, and upon RT, CT, describe the parabola CRK having its vertex in R, this parabola will be the course of the issuing fluid. For, by the construction NR or CT = 2 GN, and on account of the similar triangles SGC, CGN, SC : SG = CG : GN; hence $SC \times GN = SG \times CG$, or 2 GN, or $CT = \frac{2\,SG \times CG}{SC}$. But from the similarity of triangles CS : CG = SG : GN and CS : CG = CG : CN, consequently, when CG is radius or = R, GN will be the sine m of the angle GCS, and CN its cosine n; and we shall then have, by Euclid VI. 16. and reduction $SG = \frac{CS \times m}{R}$, and $CG = \frac{CS \times n}{R}$. By substituting these values of SG and CG in the equation $CT = \frac{2\ SG \times CG}{SC}$, we have $CT = \frac{2}{SC} \times \frac{CS \times m}{R} \times \frac{CS \times n}{R} = \frac{2\ CS \times m \times CS \times n}{CS \times R \times R} = \frac{2\ CS \times m\,n}{R^2} = 2\,a \times \frac{m\,n}{R^2}$. But the parameter P of the parabola CRK is equal to $\frac{\overline{CT}^2}{RT}$, because it is a third proportional to the abscissa and its ordinate, therefore $P = \frac{4\,a^2 \times m^2\,n^2}{R^2 \times RT}$. Now RT = CN, and $CN = \frac{NG \times n}{m}$, because CN : NG = m : n, or $CN = RT = a \times \frac{n^2}{R^2}$ by substituting the preceding value of NG. Therefore, the parameter $P = \left(\frac{4\,a^2 \times m^2\,n^2}{R^4}\right) \div \left(\frac{a \times n^2}{R^2}\right) = 4\,a \times \frac{m^2}{R^2}$, which is the same value of the parameter as was found in the preceding article, and therefore verifies the construction.

203. Cor. 1. Since NG = GR and CT = TK, the amplitude or distance CT, to which the fluid will reach on a horizontal plane, will be 4 NG, or quadruple the sine of the angle formed by the direction of the jet and a vertical line, the chord of the arch CG, being radius.

204. Cor. 2. If S n be made equal to CN, and $n\,g$ be drawn parallel to CT, and $g\,r$ be made equal to $n\,g$; then, if the direction of the jet be C g, the fluid will describe the parabola C r K whose vertex is r, and will meet the horizontal line in K, because $n\,g$ = NG, and 4 $n\,g$ = 4 NG = CK. The same may be shewn of every other pair of parabolas, whose vertices R r are equidistant from $a\ c$, a horizontal line passing through the centre of the circle.

205. Cor. 3. Draw the ordinate $a\ b$ through the centre a, and since this is the greatest ordinate that can be drawn, the distance to which the water will spout, being equal to 4 a, will be the greatest when its line of direction passes through b, that is, when it makes an angle of 45° with the horizon.

206. Cor. 4. If an orifice be made in the vessel AB at N, and the water issues horizontally in the direction NG, it will describe the parabola NT, and CT will be equal to 2 NG. For (by Prop. IX. note) the parameter of the parabola NT is equal to 4 NS, and by the property of the parabola $\overline{CT}^2 = NC \times 4\ NS$, or $\frac{1}{2}\ CT = 2\sqrt{NC \times NS}$; but by the property of the circle (Geom. Sect. IV. Theor. XXVIII.) $\overline{NG}^2 = NC \times NS$, and $NG = \sqrt{NC \times NS}$, hence CT = 2 NG. If the fluid is discharged from the orifice at n, so that S n = CN, $n\,g$ will be = NG, and it will spout to the same distance CT.

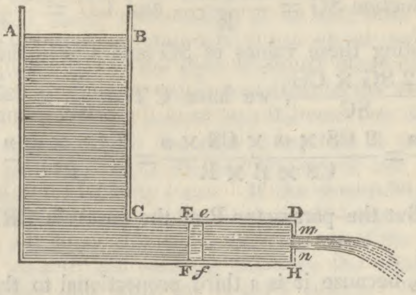
Prop. X.

207. To determine the pressure exerted upon pipes by the water which flows through them.

Fig. 68.

Let us suppose the column of fluid CD divided into an infinite number of laminæ EF $f\,e$. Then friction being abstracted, every particle of each lamina will move with the same velocity when the pipe CD is horizontal. Now, the velocity at the vena contracta $m\ n$ may be expressed by $\sqrt{A}$, A being the altitude of the fluid in the reservoir.

Fig. 68.



But the velocity at the *vena contracta* is to the velocity in the pipe, as the area of the latter is to the area of the former. Therefore δ being the diameter of the *vena contracta*, and d that of the pipe CD, the area of the one will be to the area of the other, as $\delta^2 : d^2$, (Geometry, Sect. VI. Prop. IV.) consequently we shall have $d^2 : \delta^2 = \sqrt{A} : \frac{\delta^2\sqrt{A}}{d^2}$, the velocity of the water in the pipe. But since the velocity $\sqrt{A}$ is due to the altitude A, the velocity $\frac{\delta^2\sqrt{A}}{d^2}$ will be due to the altitude $\frac{\delta^4 A}{d^4}$. Now, as each particle of fluid which successively reaches the extremity DH of the pipe, has a tendency to move with the velocity $\sqrt{A}$, while it moves only with the velocity $\frac{\delta^2\sqrt{A}}{d^2}$, the extremity D n of the pipe will sustain a pressure equal to the difference of the pressures produced by the velocities $\sqrt{A}$ and $\frac{\delta^2\sqrt{A}}{d^2}$, that is, by a pressure $A - \frac{\delta^4 A}{d^4}$, A representing the pressure which produces the velocity $\sqrt{A}$, and $\frac{\delta^4 A}{d^4}$ the pressure which produces the velocity $\frac{\delta^2\sqrt{A}}{d^2}$. But this pressure is distributed through every part of the pipe CD, consequently the pressure sustained by the sides of the pipe will be $A - \frac{\delta^4 A}{d^4}$.

208. Cor. 1. If a very small aperture be made in the side of the pipe, the water will issue with a velocity due to the height $A - \frac{\delta^4 A}{d^4}$. When the diameter δ of the orifice is equal to the diameter d of the pipe, the altitude becomes $A - A$ or nothing; and if the orifice is in this case below the pipe, the water will descend through it by drops. Hence we see the mistake of those who have maintained, that when a lateral orifice is pierced in the side of a pipe, the water will rise to a height due to the velocity of the included water.

209. Cor. 2. Since the quantities of water, discharged by the same orifice, are proportional to the square roots of the altitudes of the reservoir, or to the pressures exerted at the orifice, the quantity of water discharged by a lateral orifice may be easily found. Let W be the quantity of water discharged in a given time by the proposed aperture under the pressure A, and let w be the quantity discharged under the pressure $A - \frac{\delta^4 A}{d^4}$. Then $W : w = \sqrt{A} : \sqrt{A - \frac{\delta^4 A}{d^4}}$, consequently, $w \times \sqrt{A} = W \times \sqrt{A - \frac{\delta^4 A}{d^4}}$ and $w = \frac{W \times \sqrt{A - \frac{\delta^4 A}{d^4}}}{\sqrt{A}} = W\frac{\sqrt{d^4 - \delta^4}}{d^2}$. Therefore, since W may be determined by the experiments in the following chapter, w is known.

CHAPTER II.—ACCOUNT OF EXPERIMENTS ON THE MOTION OF WATER DISCHARGED FROM VESSELS, EITHER BY ORIFICES OR ADDITIONAL TUBES, OR RUNNING IN PIPES OR OPEN CANALS.

Ratio between the area of the vena contracta and the orifice.

210. In the preceding chapter, we have taken notice of the contraction produced upon the vein of fluid issuing from an orifice in a thin plate, and have endeavoured to ascertain its cause. According to *Sir Isaac Newton*, the diameter of the *vena contracta* is to that of the orifice as 21 to 25. *Poleni* makes it as 11 to 13; *Bernoulli* as 5 to 7; the *Chevalier de Buat* as 6 to 9; *Bossut* as 41 to 50; *Michelotti* as 4 to 5; *Venturi* as 4 to 5; *Bidone* as 33 to 50; and *Eytelwein* as 32 to 50. This ratio, however, is by no means constant. It varies with the form and position of the orifice, with the thickness of the plate in which the orifice is made, and likewise with the form of the vessel and the weight of the superincumbent fluid. But these variations are too trifling to be regarded in practice.—We shall now lay before the reader an account of the results of the experiments of different philosophers, but particularly those of the Abbé Bossut, to whom the science is deeply indebted both for the accuracy and extent of his labours.

Sect. I. *On the Quantity of Water discharged from Vessels constantly full by Orifices in thin Plates.*

211. The following table contains the results obtained by Michelotti when the orifices are vertical, and of a *square* or *circular* form, the altitude of the head of water varying from 6 feet to about 22 feet.

Michelotti's experiments.

Table I. *Shewing the Quantity of Water discharged by different Vertical Orifices.*

Altitude of Water above the centre of the orifice.				Size and form of the orifice.	Time of running.	Cubic feet of water discharged.		
Ft.	In.	Lin.	Pts.		Minutes.	Ft.	In.	Lin.
6	7	4	3	Square of 3 inches.	10	463	7	3
6	10	2	8		12	566	5	6
11	8	1	6		$8\frac{1}{2}$	516	9	5
11	9	9	10		10	612	1	5
21	8	3	6		5	415	5	3
21	8	7	0		6	499	2	8
6	7	6	0	Square of 2 inches.	15	329	9	8
11	5	1	4		15	423	5	7
21	5	3	7		10	385	4	0
6	9	1	0	Square of 1 inch.	30	158	6	7
11	10	8	1		24	163	9	6
21	6	1	0		60	562	11	4
6	8	4	0	Circular of 3 inches diameter.	15	542	10	6
11	7	1	0		12	570	11	8
21	7	4	0		8	521	3	7
6	9	5	0	Circular of 2 inches diameter.	30	488	8	3
11	8	8	0		28	589	6	5
21	10	10	0		20	575	5	10
6	10	6	0	Circular of 1 inch diameter.	60	247	4	3
11	8	11	0		60	324	1	5
22	0	2	0		60	444	6	5

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The coefficient obtained from these experiments is 0.625.

212. Messrs Brindley and Smeaton found that 20 cubic feet of water were discharged from orifices 1 inch square, in the following times, varying with the height of the water.

Height of water in feet.	Time of discharging 20 cubic feet.
1	562 seconds.
2	400
3	320
4	284
5	254

When the height of the water was 6 feet, and the orifice $\frac{1}{2}$ an inch square, 20 cubic feet were discharged in 17 minutes 33 seconds. The coefficient obtained from these experiments is 0.63.

213. When the water stands always at the upper surface of a rectangular aperture, without the upper edge, the aperture is called a *notch*. The following table shews the time of discharging 20 cubic feet, through notches 6 inches wide, of various depths.

Depth of the notch in inches.	Time of discharging 20 cubic feet.
1	436 seconds.
$1\frac{3}{8}$	295
$2\frac{5}{10}$	139
$3\frac{1}{8}$	93
$6\frac{1}{2}$	30
5	46
$1\frac{1}{4}$	326
$1\frac{5}{8}$	230
$5\frac{5}{8}$	47

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214. In the following experiments by the Abbé Bossut which were frequently repeated in various ways, the orifice was pierced in a plate of copper about half a line thick. When the orifice is in the bottom of the vessel, it is called a *horizontal* orifice; and when it is in the side of it, it is called a *lateral* orifice.

TABLE II. *Shewing the Quantity of Water discharged in one minute, by orifices differing in form and position.*

Altitude of the fluid above the centre of the orifice.	Form and position of the orifice.	The orifice's diameter.	No. of cub. in. dischar-ged in a minute.
Ft. In. Lin.			
11 8 10	Circular and Horizontal	6 lines	2311
	Circular and Horizontal	1 inch	9281
	Circular and Horizontal	2 inches	37203
	Rectangular and Horizontal.	1 inch by 3 lines	2933
	Horizontal and Square	1 inch, side	11817
	Horizontal and Square	2 inch, side	47361
9 0 0	Lateral and Circular	6 lines	2018
	Lateral and Circular	1 inch	8135
4 0 0	Lateral and Circular	6 lines	1353
	Lateral and Circular	1 inch	5436
5 0 7	Lateral and Circular	1 inch	628

Experiments on the Motion of Fluids.

215. From the results contained in the preceding table, we may draw the following conclusions.

1. That the quantities of water discharged in equal times by different apertures, the altitudes of the fluid being the same, are very nearly as the areas of the orifices. That is, if A or a represent the areas of the orifices, and W, w the quantities of water discharged,

$$W : w = A : a.$$

2. The quantities discharged in equal times by the same aperture, the altitude of the fluid being different, are to one another very nearly as the square roots of the altitudes of the water in the reservoir, reckoning from the centres of the orifices. That is, if H, h be the different altitudes of the fluid, we shall have $W : w = \sqrt{H} : \sqrt{h}$.

3. Hence we may conclude in general, that the quantities discharged in the same time by different apertures, and under different altitudes in the reservoir, are in the compound ratio of the areas of the orifices, and the square roots of the altitudes. Thus, if W, w be the quantities discharged in the same time from the orifices A, a, under the same altitude of water; and if W′, w be the quantities discharged in the same time by the same aperture a under different altitudes, H, h: then by the first of the two preceding articles

$W : w = A : a$, and by the second

$w : W = \sqrt{H} : \sqrt{h}$. Multiplying these analogies together, gives us

$$Ww : W'w = A\sqrt{H} : a\sqrt{h}, \text{ and by dividing by } w,$$
$$W : W' = A\sqrt{H} : a\sqrt{h}.$$

This rule is sufficiently correct in practice; but when great accuracy is required, the following remarks must be attended to.

4. Small orifices discharge less water in proportion than great ones, the altitude of the fluid being the same. The circumferences of the small orifices being greater in proportion to the issuing column of fluid than the circumferences of greater ones, the friction, which increases with the area of the rubbing surfaces, will also be greater, and will therefore diminish the velocity, and consequently the quantity discharged.

5. Hence of several orifices whose areas are equal, that which has the smallest circumference will discharge more water than the rest under the same altitude of fluid in the reservoir, because in this case the friction will be least. Circular orifices, therefore, are the most advantageous of all, for the circumference of a circle is the shortest of all lines that can be employed to inclose a given space.

6. In consequence of a small increase which the contraction of the vein of fluid undergoes, in proportion as the altitude of the water in the reservoir augments, the quantity discharged ought also to diminish a little as that altitude increases.

By attending to the preceding observations, the results of theory may be so corrected, that the quantities of water discharged in a given time may be determined with the greatest accuracy possible.

Comparison between the theoretical and real discharges from a circular orifice.

216. The Abbé Bossut has given the following table containing a comparison of the theoretical with the real discharges, for an orifice one inch in diameter, and for different altitudes of the fluid in the reservoir. The real discharges were not found immediately by experiment, but were determined by the precautions pointed out in the preceding articles, and may be regarded to be as accurate as if direct experiments had been employed. The fourth column was computed by M. Prony.[1]

[1] *Architecture Hydraulique*, tom. i. p. 369.

Experiments on the Motion of Fluids.

TABLE III. *Comparison of the Theoretic with the Real Discharges from an Orifice one inch in diameter.*

Constant altitude of the water in the reservoir above the centre of the orifice.	Theoretical discharges through a circular orifice *one* inch in diameter.	Real discharges in the same time through the same orifice.	Ratio of the theoretical to the real discharges.
Paris Feet.	Cubic Inches.	Cubic Inches.	
1	4381	2722	1 to 0.62133
2	6196	3846	1 to 0.62073
3	7589	4710	1 to 0.62064
4	8763	5436	1 to 0.62034
5	9797	6075	1 to 0.62010
6	10732	6654	1 to 0.62000
7	11592	7183	1 to 0.61965
8	12392	7672	1 to 0.61911
9	13144	8135	1 to 0.61892
10	13855	8574	1 to 0.61883
11	14530	8990	1 to 0.61873
12	15180	9384	1 to 0.61819
13	15797	9764	1 to 0.61810
14	16393	10150	1 to 0.61795
15	16968	10472	1 to 0.61716
1	2	3	4

Deduction from the preceding table.

217. It is evident from the preceding table, that the theoretical, as well as the real discharges, are nearly proportional to the square roots of the altitudes of the fluid in the reservoir. Thus, if we take the altitudes 1 and 4, whose square roots are as 1 to 2, the real discharges taken from the table are 2722, 5436, which are to one another very nearly as 1 to 2, their real ratio being as 1 to 1.997.

The fourth column of the preceding table also shews us that the theoretical are to the real discharges nearly in the ratio of 1 to 0.62, or more accurately, as 1 to 0.61938; therefore 0.62 is the number by which we must multiply the discharges as found by the formulæ in the preceding chapter, in order to have the quantities of water actually discharged.

Application and use of the preceding table.

218. In order to find the quantities of fluid discharged by orifices of different sizes, and under different altitudes of water in the reservoir, we must use the table in the following manner. Let it be required, for example, to find the quantity of water furnished by an orifice three inches in diameter, the altitude of the water in the reservoir being 30 feet. As the real discharges are in the compound ratio of the area of the orifices, and the square roots of the altitudes of the fluid (art. 215, No. 3), and as the theoretical quantity of water discharged by an orifice one inch in diameter, is by the second column of the table 16918 cubic inches in a minute, we shall have this analogy, $1\sqrt{15}:9\sqrt{30}=16968:215961$ cubic inches, the quantity required. This quantity being diminished in the ratio of 1 to .62, being the ratio of the theoretical to the actual discharges, gives 133896 for the real quantity of water discharged by the given orifice. But (by No. 5 of art. 215), the quantity discharged ought to be a little greater than 133896, because greater orifices discharge more than small ones; and by No. 6 the quantity ought to be less than 133896, because the altitude of the fluid is double that in the table. These two causes therefore having a tendency to increase and diminish the quantity deduced from the preceding table, we may regard 133896 as very near the truth. Had the orifice been less than one inch, or the altitude less than 15 feet, it would have been necessary to diminish the preceding answer by a few cubic inches. Since the velocities of the issuing fluid are as the quantities discharged, the preceding results may be employed also to find the real velocities from those which are deduced from theory.

To determine the velocity.

219. As the velocity of falling bodies is 16.087 feet per second, the velocity due to 16.087 feet will be 32.174 feet per second, and as the velocities are as the square roots of the height, we shall have $\sqrt{16.087}:\sqrt{H}=32.174:V$ the velocity due to any other height, consequently $V=\frac{32.174\sqrt{H}}{\sqrt{16.087}}=\frac{32.174\sqrt{H}}{4.011}=8.016\sqrt{H}$, so that 8.016 is the coefficient by which we must always multiply the altitude of the fluid in order to have its theoretical velocity.

220. The following are the coefficients according to various authors, or the ratio of the theoretical to the real discharges from a circular orifice:

Michelotti	0.649
———	0.625
Borda	0.646
Venturi	0.640
Eytelwein	0.640
Hachette	0.690
Newton	0.707
Helsham	0.705
Brindley	0.631
Smeaton	0.631
Banks	0.750
Bossut	0.610
Rennie[1]	0.621

SECT. II. *On the Quantity of Water discharged from Vessels constantly full, by small Tubes adapted to Circular Orifices.*

Quantities of water discharged by small tubes.

221. The difference between the actual discharges, and those deduced from theory, arises from the contraction of the fluid vein, and from the friction of the water against the circumference of the orifice. If the operation of any of these causes could be prevented, the quantities of water actually discharged would approach nearer the theoretical discharges. There is no probability of diminishing friction in the present case by the application of unguents; but if a short cylindrical tube be inserted in the orifice of the vessel, the water will follow the sides of the tube, the contraction of the fluid vein will be in a great measure prevented, and the actual discharges will approximate much nearer to those deduced from theory, than when the fluid issues through a simple orifice.

When the cylindrical tube is two inches long and two in diameter, the fluid vein is contracted as in simple orifices.

222. If a cylindrical tube two inches long, and two inches in diameter, be inserted in the reservoir, and if this orifice is stopped by a piston till the reservoir is filled with water, the fluid, when permitted to escape, will not follow the sides of the tube, that is, the tube will not be filled with water, and the contraction in the vein of fluid will take place in the same manner as if the orifice were pierced in a thin plate. When the cylindrical tube was one inch in diameter, and two inches long, the water followed the sides of the tube, and the vein of fluid ceased to contract. While M. Bossut was repeating this experiment, he prevented the escape of the fluid by placing the instrument

[1] *Philosophical Transactions*, 1831.

[Ex]peri-[me]nts on [the] Motion of [F]luids. [Fig.] 69.

MN (see fig. 69.), consisting of a handle and a circular head, upon the interior extremity of the tube, and found, to his great surprise, that when he withdrew the instrument MN, to give passage to the water, it sometimes followed the sides of the tube, and sometimes detached itself from them, and produced a contraction in the fluid vein similar to that which took place when the first tube was employed. After a little practice, he could produce either of these effects at pleasure. The same phenomenon was exhibited when the length of the tube was diminished to one inch six lines; only it was more difficult to make the fluid follow the circumference of the tube. This effect was still more difficult to produce when its length was reduced to one inch; and when it was so small as half an inch, the water uniformly detached itself from its circumference, and formed the *vena contracta*.

223. Table IV. *Shewing the Quantities of Water discharged by Cylindrical Tubes one inch in diameter with different lengths.*

[Qu]antities [of f]luid dis[cha]rged [fro]m cylin[dric]al tubes [of t]he same [dia]meters [but] diffe[ren]t [len]gths.

	Variable lengths of the tubes expressed in lines.		Cubic inches discharged in a minute.
Constant altitude of the fluid above the superior base of the tube being 11 feet 8 inches and 10 lines.	The tube being filled with the issuing fluid.	48	12274
		24	12188
		18	12168
	The tube not filled with the issuing fluid.	18	9282

The experiments in the preceding table were made with tubes inserted in the bottom of the vessel. When the tubes were fixed horizontally in the side of the reservoir, they furnished the very same quantities of fluid, their dimensions and the altitude of the fluid remaining the same.

It appears from the preceding results, that the quantities of water discharged increase with the length of the tube, and that these quantities are very nearly as the square roots of the altitudes of the fluid above the interior orifice of the vertical tube.

We have already seen that the theoretical are to the real discharges, as 1 to 0.62, or nearly as 16.1 to 10. But by comparing the two last experiments in the preceding table, it appears that the quantity of fluid discharged by a cylindrical tube where the water follows its sides, is to the quantity discharged by the same tube when the *vena contracta* is formed, as 13 to 10; and since the same quantity must be discharged by the latter method as by a simple orifice, we may conclude that the quantity discharged according to theory, and that which is discharged by a cylindrical tube and by a simple orifice, are to one another very nearly as the numbers 16, 13, 10. Though the water therefore follows the sides of the cylindrical tube, the contraction of the fluid vein is not wholly destroyed; for the difference between the quantity discharged in this case, and that deduced from theory, is too great to be ascribed to the increase of friction which arises from the water following the circumference of the tube.

224. In order to determine the effect of tubes of different diameters, under different altitudes of water in the reservoir, M. Bossut instituted the experiments, the results of which are exhibited in the following table.

Experiments on the Motion of Fluids.

Table V. *Shewing the Quantities of Water discharged by Cylindrical Tubes two inches long, with different Diameters.*

Quantities of water discharged by cylindrical tubes of the same length but different diameters.

Constant altitude of the water above the orifice.		Diameter of the Tube.		Quantity of water discharged in a minute.
Feet.	Inches.		Lines.	Cubic inches.
3	10	The tube being filled with the issuing fluid.	6	1689
			10	4703
		The tube not filled with the issuing fluid.	6	1293
			10	3598
2	0	The tube being filled with the issuing fluid.	6	1222
			10	3402
		The tube not filled with the issuing fluid.	6	935
			10	2603

225. By comparing the different numbers in this table, we may conclude,

1. That the quantities of water discharged by different cylindrical tubes of the same length, the altitude of the fluid remaining the same, are nearly as the areas of the orifices, or the squares of their diameters.
2. That the quantities discharged by cylindrical tubes of the same diameter and length, are nearly as the square roots of the altitude of the fluid in the reservoir.
3. Hence the quantities discharged during the same time, by tubes of different diameters, under different altitudes of fluid in the reservoir, are nearly in the compound ratio of the squares of the diameters of the tube, and the square roots of the altitudes of the water in the reservoir.
4. By comparing these results with those which were deduced from the experiments with simple orifices, it will be seen that the discharges follow the same laws in cylindrical tubes as in simple orifices.

226. Table VI. *Comparison of the Theoretical with the Real Discharges from a Cylindrical Tube one inch in Diameter, and two inches long.*

Comparison of the theoretical with the real discharges in *cylindrical* tubes.

Constant altitude of the water in the reservoir above the centre of the orifice.	Theoretical discharges through a circular orifice one inch in diameter.	Real discharges in the same time by a cylindrical tube *one* inch in diameter and *two* inches long.	Ratio of the theoretical to the real discharges.
Paris Feet.	Cubic Inches.	Cubic Inches.	
1	4381	3539	1 to 0.81781
2	6196	5002	1 to 0.80729
3	7589	6126	1 to 0.80724
4	8763	7070	1 to 0.80681
5	9797	7900	1 to 0.80638
6	10732	8654	1 to 0.80638
7	11592	9340	1 to 0.80573
8	12392	9975	1 to 0.80496
9	13144	10579	1 to 0.80485
10	13855	11151	1 to 0.80483
11	14530	11693	1 to 0.80477
12	15180	12205	1 to 0.80403
13	15797	12699	1 to 0.80390
14	16393	13177	1 to 0.80382
15	16968	13620	1 to 0.80270
1	2	3	4

Experiments on the Motion of Fluids.

The above table is deduced from the foregoing experiments, and contains a comparative view of the quantities of water discharged by a simple orifice, according to theory, and those discharged by a cylindrical tube of the same diameter under different altitudes of water. The numbers might have been more accurate by attending to some of the preceding remarks; but they are sufficiently exact for any practical purpose. The fourth column, containing the ratio between the theoretical and actual discharges, was computed by M. Prony.

By comparing the preceding table with that in art. 216, we shall find that cylindrical tubes discharge a much greater quantity of water than simple orifices of the same diameter, and that the quantities discharged are as 81 to 62 nearly. This is a curious phenomenon, and will be afterwards explained.

227. The application of this table to other additional tubes under different altitudes of the fluid, not contained in the first column, is very simple. Let it be required, for example, to find the quantity of water discharged by a cylindrical tube, 4 inches in diameter, and 8 inches long, the altitude of the fluid in the reservoir being 25 feet. In order to resolve this question, find (by art. 218) the theoretical quantity discharged, which in the present instance will be 350490 cubic inches, and this number diminished in the ratio of 1 to 0.81 will give 284773 for the quantity required. The length of the tube in this example was made 8 inches, because, when the length of the tube is less than twice its diameter, the water does not easily follow its interior circumference. If the tube were longer than 8 inches, the quantity of fluid discharged would have been greater, because it uniformly increases with the length of the tube; the greatest length of the tube being always small, in comparison with the altitude of the fluid in the reservoir.

228. Hitherto we have supposed the tube to be exactly cylindrical. When its interior surface, however, is conical, the quantities discharged undergo a considerable variation, which may be estimated from the following experiments of the Marquis Poleni, published in his work, *De Castellis per quæ derivantur Fluviorum aquæ*, which appeared at Padua in 1718.

Experiments on the Motion of Fluids.

TABLE VII. *Shewing the Quantities of Water discharged by Conical Tubes of different Diameters.*

Quantities of water discharged by *conical* tubes, according to the experiments of M. Poleni.

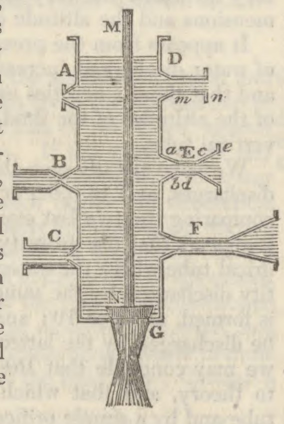
		Apertures employed.	Interior diameter.	Exterior diameter.	Quantity discharged in a min. in cubic feet.	Time in which 73035 cub. in. were discharged.
Constant altitude of the water in the reservoir, 256 lines, or 1 foot 9 inches and 4 lines.	Length of each tube 92 lines, or 7 inches 8 lines.	Orifice in a thin plate,	26 lines	26 lines	15877	4′ 36″
		Cylindrical tube, .	26 ...	26 ...	23434	3′ 7″
		1st Conical tube, .	33 ...	26 ...	24758	2′ 57″
		2d Conical tube, .	42 ...	26 ...	24619	2′ 58″
		3d Conical tube, .	60 ...	26 ...	24345	3′ 0″
		4th Conical tube, .	118 ...	26 ...	23687	3′ 5″

From these experiments we are authorized to conclude, 1. That the real discharges are less than those deduced from theory, which in the present case is 27425 cubic inches in a minute; and, 2. That when the interior orifice of the tube is enlarged to a certain degree, the quantity discharged is increased; but that when this enlargement is too great, a contraction takes place without the exterior orifice, and the quantity discharged suffers a diminution. If the smallest base of the conical tube be inserted in the side of the reservoir, it will furnish more water than a cylindrical tube whose diameter is equal to the smallest diameter of the conical tube; for the divergency of its sides changes the oblique motion which the particles would otherwise have had, when passing from the reservoir into the tube.

229. The experiments of Poleni and Bossut having been made only with tubes of a conical and cylindrical form, M. Venturi was induced to institute a set of experiments, in which he employed tubes of the various forms exhibited in fig. 69. The results of his researches are contained in the following table, for which we have computed the column containing the number of cubic inches discharged in one minute, in order that the experiments of the Italian philosopher may be more easily compared with those which are exhibited in the preceding tables. The constant altitude of the water in the reservoir was 32.5 French inches, or 34.642 English inches. The quantity of water which flowed out of the vessel in the times contained in the first column was 4 French cubic feet, or 4.845 English cubic feet. The measures in the table are all English, unless the contrary be expressed.

Experiments of Venturi with tubes of various forms.

Fig. 69.



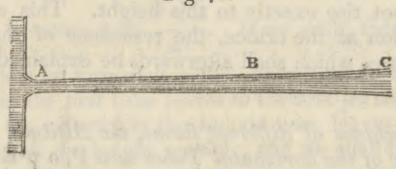
Experiments on the Motion of Fluids.

TABLE VIII. *Shewing the Quantities of Water discharged from Orifices of various forms, the constant Altitude of the Fluid being 32.5 French, or 34.642 English inches.*

No.	Nature and dimensions of the tubes and orifices.	Time in which 4 Paris cubic feet were discharged.	Paris cubic inches discharged in a minute.
		Seconds.	
1	A simple circular orifice in a thin plate, the diameter of the aperture being 1.6 inches, ...	41	10115
2	A cylindrical tube 1.6 inches in diameter, and 4.8 inches long, .	31	13378
3	A tube similar to B, fig. 69, which differs from the preceding only in having the contraction in the shape of the natural contracted vein,	31	13378
4	The short conical adjutage A, fig. 69, being the first conical part of the preceding tube, ...	42	9874
5	The tube D, fig. 69, being a cylindrical tube adapted to the small conical end A, *mn* being 3.2 inches long, ...	42.5	9758
6	The same adjutage, *mn* being 12.8 inches, . . .	45	9216
7	The same adjutage, *mn* being 25.6 inches, . . .	48	8640
8	The tube C, consisting of the cylindrical tube of Exp. 2, placed over the conical part of A, ...	32.5	12760
9	The double conical pipe E, $ab = ac = 1.6$ inches, $cd = 0.977$ inches, $ef = 1.376$ inches, and the length ce of the outer cone $= 4.351$ inches,	27.5	15081
10	The tube F, consisting of a cylindrical tube 3.2 inches long, and 1.376 inches in diameter, interposed between the two conical parts of the preceding, ...	28.5	14516

230. These experiments of Venturi inform us of a curious fact, extremely useful to the practical hydraulist. They incontestably prove, that when water is conveyed through a straight cylindrical pipe of an unlimited length, the discharge of water may be increased only by altering the form of the terminations of the pipe; that is, by making the end of the pipe A, fig. 70, of the same form as the *vena*

Fig. 70.



contracta, and by forming the other extremity BC into a truncated cone, having its length BC about nine times the diameter of the cylindrical tube AB, and the aperture at C to that at B, as 18 to 10. By giving this form to the pipe, it will discharge more than twice as much water in a given time, the quantity discharged by the cylindrical pipe being to the quantity discharged by the pipe of the form ABC, as 10 to 24.

231. M. Venturi also found, that the quantities of water discharged out of a straight tube, a curved tube forming a quadrantal arc, and an elbowed tube with an angle of 90°, each branch having a horizontal position, are to one another nearly as the numbers 70, 50, 45. Hence we see the disadvantages of sinuosities and bendings in conduit pipes. In the construction of hydraulic machines, any variation in the internal diameter of the pipe ought to be carefully avoided, excepting those alterations at the extremities which we have recommended in the preceding paragraph.

232. It appears from the researches of Eytelwein, that when the shortest tube that will make the water follow its sides is applied to the reservoir, the quantity discharged will be to that deduced from theory, as 0.810 to 1.000, and the multiplier for finding the velocity will be 6.5. When the lengths of the tubes are increased from *two* to *four* times their diameter, the ratio of the actual and theoretical discharge will be 0.822 to 1.000, and the constant multiplier for finding the velocity will be 6.6. In employing a conical tube approaching to the figure of the *vena contracta*, the ratio of the discharges was as 0.92 to 1.00, and when its edges were rounded off, as 0.98 to 1.00 computing from its least section. He found also that the smallest quantity of water was discharged, when the interior extremity of the tube projected within the reservoir, the quantity furnished in this case being reduced to one half of what was discharged when the tube had its proper position.

Reason why cylindrical tubes furnish more water than orifices of the same diameter.

233. When a cylindrical tube is applied to an orifice, the oblique motion of the particles which enter it is diminished; the vertical velocity of the particles, therefore, is increased, and consequently the quantity of water discharged. M. Venturi maintains that the pressure of the atmosphere increases the expense of water through a simple cylindrical tube, and that in conical tubes, the pressure of the atmosphere increases the expenditure in the ratio of the exterior section of the tube to the section of the contracted vein, whatever be the position of the tube.

Best form for tubes employed to discharge water.

234. Of all the tubes that can be employed for discharging water, that is the most advantageous which has the form of a contracted vein. Hence, it will be a truncated cone with its greatest base next the reservoir, having its length equal to half the diameter of that base, and the area of the two orifices as 8 to 5, or their diameters in the subduplicate ratio of these numbers, viz. as $\sqrt{8} : \sqrt{5}$.

SECT. III.—*Experiments on the Exhaustion of Vessels.*

Difficulty in determining the time when a vessel is completely exhausted.

235. It is almost impossible to determine the exact time in which any vessel of water is completely exhausted. When the surface of the fluid has descended within a few inches of the orifice, a kind of conoidal funnel is formed immediately above the orifice. The pressure of the superincumbent column being therefore removed, the time of exhaustion is prolonged. The water falls in drops; and it is next to impossible to determine the moment when the vessel is empty. Instead, therefore, of endeavouring to ascertain the time in which vessels are completely exhausted, the Abbé Bossut has determined the times in which the superior surface of the fluid descends through a certain vertical height, and his results will be found in the following table:—

Experiments on the Motion of Fluids.

TABLE IX. *Shewing the Times in which Vessels are partly exhausted.*

Primitive altitude of the water in the vessel.	Constant area of a horizontal section of the vessel.	Diameter of the circular orifice.	Depression of the upper surface of the fluid.	Time in which this depression takes place.
Paris Feet.	Square Feet.	Inches.	Feet.	Min. Sec.
11.6666	9	1	4	7 $25\frac{1}{2}$
		2	4	1 52
		1	9	20 $24\frac{1}{2}$
		2	9	5 6
PG	DE	$\sqrt{\frac{A}{.7854}}$	PG—PU	T

Comparison of the experiments with the results of theory. Figs. 63 & 64.

236. In order to compare these experimental results with those deduced from theory, we must employ the formula (in Prop. V. 195) where the time in which the surface descends through any height is $\dfrac{T=DE\times\sqrt{PG}-\sqrt{PU}}{A\sqrt{16.087}}$, in which DE is the area of a section of the vessel, PG the primitive altitude of the surface above the centre of the orifice, PU the altitude of the surface after the time T is elapsed, A the area of the orifice, and 16.087 the space through which a heavy body descends in one second of time. That the preceding formula may be corrected, we must substitute 0.62 A, or $\frac{5A}{8}$, instead of A, in the formula, 0.62, A being the area of the *vena contracta;* and as the measures in the preceding table are in Paris feet, we must use 15.085, instead of 16.087, the former being the distance in Paris feet, and the latter the distance in English feet, which falling bodies describe in a second. The formula, therefore, will become $T=\dfrac{DE\times\sqrt{PG-PU}}{0.62\,A\sqrt{15.085}}$, and when the computations are made for the different diameters of the orifices, and the different depressions of the fluid surface, the results will be had, which are exhibited in the last column of the following table, containing the values of T, according to theory and experience.

Experiments on the Motion of Fluids.

TABLE X. *Comparison of the Results of Theory with those of Experiment.*

Diameter of the circular orifice.	Depression of the upper surface of the fluid.	Time of the depression of the surface by experiment.	Time of the depression of the surface by the formula.	Difference between the theory and the experiments.
Inches.	Feet.	Min. Sec.	Min. Sec.	Seconds.
1	4	7 $25\frac{1}{2}$	7 22.36	3.14
2	4	1 52	1 50.59	1.41
1	9	20 $24\frac{1}{2}$	20 16	8.50
2	9	5 6	5 4	2.00

It appears from this table that the times of discharge, by experiment, differ very little from those deduced from the corrected formula; and that the latter always err in defect. This may arise from 0.62 being too great a multiplier for finding the corrected diameter of the orifice. When the orifices are in the sides of the reservoir, the altitude PG, PU of the surface may be reckoned from the centre of gravity of the orifice, unless when it is very large.

SECT. IV. *Experiments on Vertical and Oblique Jets.*

Vertical jets do not rise to the same altitude as that of their reservoirs.

237. We have already seen that, according to theory, vertical jets should rise to the same altitude as that of the reservoirs from which they are supplied. It will appear, however, from the following experiments of Bossut, that jets do not rise exactly to this height. This arises from the friction at the orifice, the resistance of the air, and other causes which shall afterwards be explained.

Fig. 71.

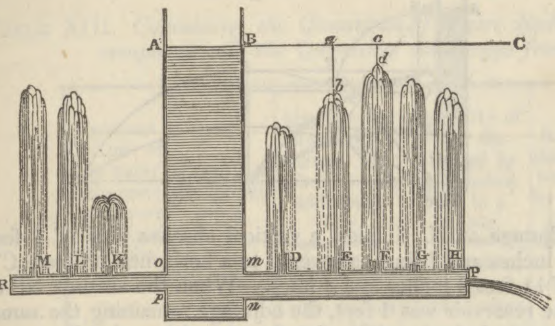
TABLE XI. *Containing the Altitudes to which Jets rise through Adjutages of different forms, the Altitude of the Reservoir being Eleven Feet, reckoning from the upper surface of the horizontal Tubes* m n P, o p R.

Diameter of the horizontal tubes *m* P, *o* R, each being six feet long.	Form of the orifices.	References to Fig. 71.	Diameter of the orifice.	Altitude of the jet when rising vertically, reckoning from *m*.	Altitude of the jet when inclined a little to the vertical.	Description of the jets.
Inch. Lines			Lines.	Feet. Inch. Lines.	Feet. Inch. Lines.	
3 8	Simple orifice	H	2	10 0 10	10 4 6	The vertical jet beautiful.
3 8	——	G	4	10 5 10	10 7 6	The vertical jet beautiful, not much enlarged at the top.
3 8	——	F	8	10 6 6	10 8 0	All the jets occasionally rise to different heights. This very perceptible in the present experiment. The vertical jet. much enlarged at top. The inclined one less so, and more beautiful.
3 8	Conical tube	E	94 by 70	9 6 4	9 8 6	The vertical jet beautiful.
3 8	Cylindrical tube	D	4 by 70	9 1 6	7 3 6	The vertical jet beautiful.
0 $9\frac{1}{2}$	Simple orifice	M	2	9 11 0	— — —	The jet beautiful.
0 $9\frac{1}{2}$	——	L	4	9 7 10	— — —	The jet much deformed, and very much enlarged at top.
0 $9\frac{1}{2}$	——	K	8	7 10 0	— — —	The column much broken; and the successive jets detached from each other.

Experiments on the Motion of Fluids.

238. It appears, from the three first experiments of the preceding table, that *great jets rise higher than small ones;*

Fig. 71.



Ratio between the diameters of the tube and the adjutage for giving a maximum height to the jet.

and from the three last experiments, that *small jets rise higher than great ones when the horizontal tube is very narrow.* There is, therefore, a certain proportion between the diameter of the horizontal tube and that of the adjutage or orifice, which will give a maximum height to the jet. This proportion may be found in the following manner. Let D be the diameter of the tube, d that of the adjutage, a the altitude B m of the reservoir, b the velocity along the tube; and as the velocity at the adjutage is constant, it may be expressed by $\sqrt{a}$. Now (art. 189, note) the velocity in the tube is to the velocity at the adjutage as the area of their respective sections, that is, as the square of the diameter of the one is to the square of the diameter of the other. Therefore, $\sqrt{a} : b = D^2 : d^2$, and, consequently, $b = \frac{d^2 \sqrt{a}}{D^2}$. If there is another tube and another adjutage, the corresponding quantities may be the same letters in the Greek character, viz. Δ, δ, α, β, and we shall have the equation $\beta = \frac{\delta^2 \sqrt{\alpha}}{\Delta^2}$. If we wish, therefore, that the two jets be furnished in the same manner, then if the velocity in the first tube leaves to the first jet all the height possible, the velocity in the second tube leaves also to the second jet all the height possible, and we shall have $b = \beta$, or $\frac{d^2 \sqrt{a}}{D^2} = \frac{\delta^2 \sqrt{\alpha}}{\Delta^2}$. Hence $D^2 : \Delta^2 = d\, d \sqrt{a} : \delta\, \delta \sqrt{\alpha}$, that is, *the squares of the diameters of the horizontal tubes ought to be to one another in the compound ratio of the squares of the diameters of the adjutages, and the square roots of the altitudes of the reservoir.* Now, it appears from the experiments of Mariotte (*Traité du Mouvement des Eaux*), that when the altitude of the reservoir is 16 feet, and the diameter of the adjutage six lines, the diameter of the horizontal tube ought to be 28 lines and a half. By taking this as a standard, therefore, the diameters of the horizontal tube may be easily found by the preceding rule, whatever be the altitude of the reservoir and the diameter of the adjutage.

It results from the three last experiments, that the jets rise to the smaller height when the adjutage is a cylindrical tube (see D, fig. 71.), that a conical adjutage throws the fluid very much higher, and that when the adjutage is a simple orifice the jet rises highest of all.

Fig. 71.

239. By comparing the preceding experiments with those of Mariotte, it appears, that *the differences between the heights of vertical jets, and the heights of the reservoir, are nearly as the squares of the heights of the jets.* Thus, $a\,b : c\,d = \overline{E\,b^2} : \overline{F d^2}$; therefore, if $a\,b$ be known by experiment, we shall have $c\,d = \frac{a\,b \times F\,d^2}{E\,b^2}$, and by adding $c\,d$ to F d, we shall have the altitude of the reservoir. But if F c were given, and it were required to find F d, the height of the jet, we have, by the preceding analogy, $\overline{F\,d^2} = \frac{\overline{E\,b^2} \times c\,d}{a\,b}$. But $c\,d$ is an unknown quantity, and is equal to F c — F d, therefore, by substitution, $F\,d^2 = \frac{\overline{E\,b^2} \times \overline{F\,c - F\,d}}{a\,b}$, or $\overline{F d^2} \times \frac{\overline{E\,b^2}}{a\,b} \times \overline{F\,d} = \frac{E\,b^2 \times F\,c}{a\,b}$, which is evidently a quadratic equation, which, after reduction, becomes $F\,d = \sqrt{\frac{\overline{E\,b^2} \times F\,c}{a\,b} + \frac{\overline{E\,b^4}}{4}} - \frac{E\,b^2}{2}$.

A small inclination of the jet increases its altitude.

240. From a comparison of the 5th and 6th columns of the table, it appears that a small inclination of the jet, to a vertical line, makes it rise higher than when it ascends exactly vertical;[1] but even then it still falls short of the height of the reservoir. When the water first escapes from the adjutage, it generally springs higher than the reservoir; but this effect is merely momentary, as the jet instantly subsides, and continues at the altitudes exhibited in the foregoing tables. The great size of the jet at its first formation, and its subsequent diminution, have been ascribed by some philosophers to the elasticity of the air which follows the water in its passage through the orifice; but it is obvious, that this air, which moves along with the fluid, can never give it an impulsive force. In order to explain this phenomenon, let us suppose the adjutage to be stopped; then the air which the water drags along with it, will lodge itself at the extremity of the adjutage, so that there will be no water contiguous to the body which covers the orifice. As soon as the cover is removed from the adjutage, the imprisoned air escapes; the water immediately behind it rushes into the space which it leaves, and thus acquires in the tube a certain velocity which increases at the orifice in the ratio of the area of the section of the tube to the area of the section of the orifice (art. 189, note). When the orifice is small in comparison with the tube, the velocity of the issuing fluid must be considerable, and will raise it higher than the reservoir. But as the jet is resisted by the air, and retarded by the descending fluid, its altitude diminishes, and the simple pressure of the fluid becomes the only permanent source of its velocity. The preceding phenomenon was first noticed by Toricellius,[2] who seems to ascribe the diminution in the altitude of the jet to the gravity of the descending particles.

The jet rises higher than the reservoir at its commencement.

241. The following table exhibits all that is necessary in the formation of jets. The two first columns are taken from Mariotte,[3] and shew the altitude of the reservoir requisite to producing a jet of a certain height. The third column contains, in Paris pints, 36 of which are equal to a cubic foot, the quantity of water discharged in a minute by an orifice six lines in diameter. The fourth column, computed from the hypothesis in art. 238 contains the diameters of the horizontal tubes for an adjutage six lines in diameter, relative to the altitudes in the second column. The thickness of the horizontal tubes will be determined in a subsequent section.

[1] This was also observed by Wolfius, *Opera Mathematica*, tom. i. p. 802, schol. iv.

[2] *De Motu Projectorum. Oper. Geometr.* p. 192.

[3] *Traité du Mouvement des Eaux*, part iv. disc. 1. p. 303.

Experiments on the Motion of Fluids.

TABLE XII. *Containing the Altitudes of Reservoirs, the Diameters of the Horizontal Tubes, &c. for Jets of different heights.*

Altitude of the jet.	Altitude of the reservoir.		Quantity of water discharged in a minute from an adjutage 6 lines in diameter.	Diameters of the horizontal tubes suited to the two preceding columns.
Paris Feet.	Feet.	Inches.	Paris Pints.	Lines.
5	5	1	32	21
10	10	4	45	26
15	15	9	56	28
20	21	4	65	31
25	27	1	73	33
30	33	0	81	34
35	39	1	88	36
40	45	4	95	37
45	51	9	101	38
50	58	4	108	39
55	65	1	114	40
60	72	0	120	41
65	79	1	125	42
70	86	4	131	43
75	93	9	136	44
80	101	4	142	45
85	109	1	147	46
90	117	0	152	47
95	125	1	158	48
100	133	4	163	49

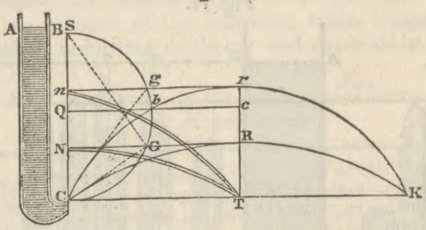
242. We have already seen that jets do not rise to the heights of their reservoirs; and have remarked that the difference between theory and experiment arises from the friction at the orifice, and the resistance of the air. The diminution of velocity produced by friction is very small, and the resistance of the air is a very inconsiderable source of retardation, unless when the jet rises to a great altitude. We must seek, therefore, for another cause of obstruction to the rising jet, which, when combined with these, may be adequate to the effect produced. Wolfius[1] has very properly ascribed the diminution in the altitude of the jet to the gravity of the falling water. When the velocity of the foremost particles is completely spent, those immediately behind, by impinging against them, lose their velocity, and, in consequence of this constant struggle between the ascending and descending fluid, the jet continues at an altitude less than that of the reservoir. Hence we may discover the reason why an inclination of the jet increases its altitude; for the descending fluid falling a little to one side does not encounter the rising particles, and therefore permits them to reach a greater altitude than when their ascension is in a vertical line. Wolfius observes, in proof of his remark that the diminution is occasioned also by the weight of the *ascending* fluid, that mercury rises to a less height than water: but this cannot be owing to the greater specific gravity of mercury; for though the weight of the mercurial particles is greater than that of water, yet the momentum with which they ascend is proportionally greater, and therefore the resistance which opposes their tendency downwards, has the same relation to their gravity, as the resistance in the case of water has to the weight of the aqueous particles.

Experiments on oblique jets by Bossut.

243. The theory of oblique jets has already been discussed in Prop. IX. art. 200. The two following experiments are given by Bossut. When the height NS of the reservoir AB (fig. 72) was 9 feet, and the diameter of the

Experiments on the Motion of Fluids.

Fig. 72.



adjutage at N, 6 lines, a vertical abscissa CN of 4 feet 3 inches and 7 lines, answered to a horizontal ordinate CT of 11 feet 3 inches and 3 lines. When the altitude NS of the reservoir was 4 feet, the adjutage remaining the same, a vertical abscissa CN of 4 feet 3 inches and 7 lines, corresponded with a horizontal ordinate CT of 8 feet 2 inches and 8 lines. The real amplitudes, therefore, are less than those deduced from theory; and both are very nearly as the square roots of the altitudes of the reservoirs. Hence, to find the amplitude of a jet when the height of the reservoir is 10 feet, and the vertical abscissa the same, we have $\sqrt{9}$ feet : $\sqrt{16}$ feet $=$ 11 feet 3 inches 3 lines : 15 feet 4 lines, the amplitude of the jet required. This rule, however, will apply only to small reservoirs; for when the jets enlarge, the curve which they describe cannot be determined by theory, and therefore the relation between the amplitudes and the heights of the reservoirs must be uncertain.

By Michelotti and Venturi.

244. The following experiments on oblique jets were performed by MM. Michelotti and Venturi. When the height of the adjutage above a horizontal plane was 19.33 inches, the amplitude of projection, according to Michelotti, was 23.2 inches, with a simple orifice, and 20 inches with an additional tube. Venturi found, that when the height of the water in the reservoir was $32\frac{1}{2}$ inches, and that of the adjutage above a horizontal plane 54 inches, the amplitude of projection was $81\frac{1}{2}$ inches with a simple orifice, and 69 inches with an additional tube.

SECT. V. *Experiments on the Motion of Water in Conduit Pipes.*

Motion of water in conduit pipes.

245. The experiments of the Chevalier de Buat will be given at great length in the article WATER-WORKS. That the reader, however, may be in possession of every thing valuable on a subject of such public importance, we shall at present give a concise view of the experiments of Couplet, Bossut, and Prony, and of the practical conclusions which they authorize us to form.

246. It must be evident to every reader, that, when water is conducted from a reservoir by means of a long horizontal pipe, the velocity with which the water enters the pipe will be much greater than the velocity with which it issues from its farther extremity; and that, if the pipe has various flexures or bendings, the velocity with which the water leaves the pipe will be still farther diminished. The difference, therefore, between the initial velocity of the water, and the velocity with which it issues, will increase with the length of the pipe and the number of its flexures. By means of the theory, corrected by the preceding experiments, it is easy to determine with great accuracy the initial velocity of the water, or that with which it enters the pipe; but on the obstructions which the fluid experiences in its progress through the pipe, and on the causes of these obstructions, theory throws but a feeble light. The experiments of Bossut afford much instruction

[1] *Wolfii Opera Mathemat.* tom. i. p. 802, schol. 4.

xperi- nts on t Motion Fluids.

on this subject; and it is from them that we have arranged the following table, containing the quantities of water discharged by pipes of different lengths and diameters, compared with the quantities discharged from additional tubes.

Experiments on the Motion of Fluids.

TABLE XIII. *Containing the Quantities of Water discharged by Conduit Pipes of different lengths and diameters, compared with the Quantities discharged from additional tubes inserted in the same Reservoir.*

Constant altitude of the water in the reservoir above the axis of the tube.	Length of the conduit pipes.	Quantity of water discharged in a minute by an additional tube. (Tube and pipe 16 lines diam.)	Quantity of water discharged by the conduit pipe in a minute. (Tube and pipe 16 lines diam.)	Ratio between the quantities of water furnished by the tube and the pipe of 16 lines diameter.	Quantity of water discharged by an additional tube in a minute. (Tube and pipe 24 lines diam.)	Quantity of water discharged by the conduit pipe in a minute. (Tube and pipe 24 lines diam.)	Ratio between the quantities of water furnished by the tube and the pipe of 24 lines diameter.
Feet.	Feet.	Cubic Inches	Cubic Inches.		Cubic Inches.	Cubic Inches.	
1	30	6330	2778	1 to .4389	14243	7680	1 to .5392
1	60	6330	1957	1 to .3091	14243	5564	1 to .3906
1	90	6330	1587	1 to .2507	14243	4534	1 to .3183
1	120	6330	1351	1 to .2134	14243	3944	1 to .2769
1	150	6330	1178	1 to .1861	14243	3486	1 to .2448
1	180	6330	1052	1 to .1662	14243	3119	1 to .2190
2	30	8939	4066	1 to .4548	20112	11219	1 to .5578
2	60	8939	2888	1 to .3231	20112	8190	1 to .4072
2	90	8939	2352	1 to .2631	20112	6812	1 to .3387
2	120	8939	2011	1 to .2250	20112	5885	1 to .2926
2	150	8939	1762	1 to .1971	20112	5232	1 to .2601
2	180	8939	1583	1 to .1770	20112	4710	1 to .2341
1	2	3	4	5	6	7	8

duc- ns from prece- g table.

247. The third column of the preceding table contains the quantity of water discharged through an additional cylindrical tube 16 lines in diameter, or the quantity discharged from the reservoir into a conduit pipe of the same diameter; and the fourth column contains the quantity discharged by the conduit pipe. The fifth column, therefore, which contains the ratio between these quantities, will also contain the ratio between the velocity of the water at its entrance into the conduit pipe, which we shall afterwards call its initial velocity, and its velocity when it issues from the pipe, which shall be denominated its final velocity; for the velocities are as the quantities discharged, when the orifices are the same. The same may be said of the 6th, 7th, and 8th columns, with this difference only, that they apply to a cylindrical tube and a conduit pipe 24 lines in diameter.

use of retar- ion of ter in ving es.

248. By examining some of the experiments in the foregoing table, it will appear that the water sometimes loses $\frac{8}{10}$ths of its initial velocity. The velocity thus lost is consumed by the friction of the water on the sides of the pipe, as the quantities discharged, and consequently the velocities diminish when the length of the pipe is increased. In simple orifices, the friction is in the inverse ratio of their diameter; and it appears from the table, that the velocity of the water is more retarded in the pipe 16 lines in diameter, than in the other, which has a diameter of 24 lines. But though the velocity decreases when the length of the tube is increased, it by no means decreases in a regular arithmetical progression, as some authors have maintained. This is obvious from the table, from which it appears, that the differences between the quantities discharged, which represent also the differences between the velocities, always *decrease*, whereas the differences would have been *equal*, had the velocities decreased in an arithmetical progression. The same truth is capable of a physical explanation. If every filament of the fluid rubbed against the sides of the conduit pipe, then, since in equal times they all experience the same degree of friction, the velocities must diminish in the direct ratio of the lengths of the tubes, and will form a regular arithmetical progression, of which the first term will be the final, and the last the initial velocity of the water. But it is only the lateral filaments that are exposed to friction. This retards their motion; and the adjacent filaments which do not touch the pipe, by the adhesion to those which do touch it, experience also a retardation, but in a less degree, and go on with the rest, each filament sustaining a diminution of velocity inversely proportional to its distance from the sides of the pipe. The lateral filaments alone, therefore, provided they always remain in contact with the sides of the pipe, will have their velocities diminished in arithmetical progression, while the velocities of the central filaments will not decrease in a much slower progression; consequently, the mean velocity of the fluid, or that to which the quantities discharged are proportional, will decrease *less* rapidly than the terms of an arithmetical progression.

249. When the altitude of the reservoir was two feet, the diminution of discharge, and consequently of velocity, was greater than when the height of the reservoir was only one foot. The cause of this is manifest. Friction increases with the velocity, because a greater number of obstructions are encountered in a certain time, and the velocities are as the square roots of the altitudes; therefore friction must also be as the square roots of the altitudes of the reservoir. On some occasions Coulomb found that the friction of solid bodies diminished with an augmentation of velocity, but there is no ground for supposing that this takes place in the case of fluids.

The retardation diminishes as the altitude of the reservoir increases.

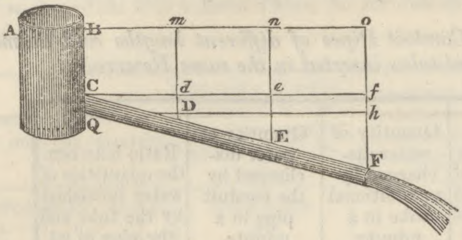
250. When the pipe is inclined to the horizon, as CGF, the water will move with a greater velocity than in the horizontal tube C G hf. In the former case, the relative gravity of the water, which is to its absolute gravity as Ff to Cf, or as the height of the inclined plane to its length, accelerates its motion along the tube. But this acceleration takes place only when the inclination is considerable; for if the angle which the direction of the pipe forms with the horizon were no more than one degree, the retardation of friction would completely counterbalance the accel-

In inclined pipes the velocity of the fluid is increased by its relative gravity. Fig. 73.

Experiments on the Motion of Fluids.

leration of gravity. Thus when the pipe CF, 16 lines in

Fig. 73.



diameter, was 177 feet, and was divided into three equal parts in the points D and E, so that CD was 59 feet, CE 118 feet; and when CF was to F*f* as 2124 to 241, the quantity of water discharged at F was 5795 cubic inches in a minute, the quantity discharged at E was 5801 cubic inches in a minute, and the quantity at D 5808 cubic inches. The quantities discharged therefore, and consequently the velocities, decreased from C to F; whereas if there had been no friction, and no adhesion between the aqueous particles, the velocities would have increased along the line CF in the subduplicate ratio of the altitudes CB, D *m*, E *n*, and F *o*; AB being the surface of the water in the reservoir. The preceding numbers, representing the quantities discharged at FE and D, decrease very slowly; consequently, by increasing the relative gravity of the water, that is, by inclining the tube more to the horizon, the effects of friction may be exactly counterbalanced. This happens when the angle *f* CF is about 6° 31′, or when F *f* is the eighth or ninth part of CF. The quantities discharged at CDE and F will be then equal, and friction will have consumed the velocity arising from the relative gravity of the included water.

Friction destroys this increase of velocity when the inclination of the pipe is 6° 31′.

251. In order to determine the effects produced by flexures or sinuosities in conduit pipes, M. Bossut made the following experiments.

Table XIV. *Shewing the Quantities of Water discharged by rectilineal and curvilineal leaden Pipes, 50 feet long, and 1 inch in diameter.*

Experiments with curvilineal pipes.

Altitude of the Water in the Reservoir.		Form of the Conduit Pipes.—See Figures 74. and 75.	Quantities of Water discharged in a Minute.
Feet.	Inches.		Cubic Inches.
0	4	The rectilineal tube MN placed horizontally,	576
1	0	The same tube similarly placed,	1050
0	4	The same tube bent into the curvilineal form ABC, fig. 74, each flexure lying flat on a horizontal plane, ABC being a horizontal section,	540
1	0	The same tube similarly placed,	1030
0	4	The same tube placed as in fig. 75, where ABCD is a vertical section, the parts A, B, C, D, rising above a horizontal plane, and the parts *a*, *b*, *c*, lying upon it,	520
1	0	The same tube similarly placed,	1028

Fig. 74.

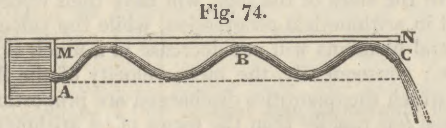
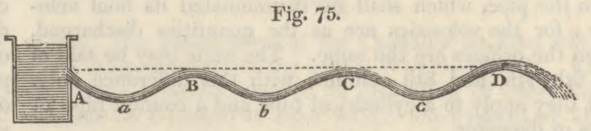


Fig. 75.



252. 1. The two first experiments of the preceding table shew, that the quantities of water discharged diminish as the altitude of the reservoir. This arises from an increase of velocity, which produces an increase of friction.

2. The four first experiments shew, that a curvilineal pipe, in which the flexures lie horizontally, discharges less water than a rectilineal pipe of the same length. The friction being the same in both cases, this difference must arise from the impulse of the fluid against the angles of the tube; for if the tube formed an accurate curve, it is demonstrable that the curvature would not diminish the velocity of the water.

3. By comparing the 1st and 5th, and the 2d and 6th, experiments, it appears that, when the flexures are vertical, the quantity discharged is diminished. This also arises from the imperfection of curvature.

4. It appears, from a comparison of the 3d and 5th, with the 4th and 6th experiments, that when the flexures are vertical, the quantity discharged is less than when they are horizontal. In the former case, the motion of the fluid arises from the central impulsion of the water, retarded by its gravity in the ascending parts of the pipe, and accelerated in the descending parts; whereas the motion, in the latter case, arises wholly from the central impulsion of the fluid. To these points of difference the diminution of velocity may somehow or other be owing.

When a large pipe has a number of contrary flexures, the air sometimes mixes with the water, and occupies the highest parts of each flexure, as at B and C, fig. 75. By this means the velocity of the fluid is greatly retarded, and the quantities discharged much diminished. This ought to be prevented by placing small tubes at B and C, having a small valve at their top. Fig. 75.

253. A set of valuable experiments, on a large scale, were made by M. Couplet upon the motion of water in conduit pipes, and a detailed account of them is given in the Memoirs of the Academy for 1732, in his paper entitled *Des Recherches sur le Mouvement des Eaux dans les Tuyaux de conduite.* These experiments are combined with those of the Abbé Bossut in the following table, which gives a distinct view of all that they have done on this subject, and will be of great use to the practical engineer.

Experiments of Couplet.

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Experiments on the Motion of Fluids.

Table containing the results of the experiments of Couplet and Bossut on conduit pipes of various kinds.

TABLE XV. *Containing the Results of the Experiments of Couplet and Bossut on Conduit Pipes differing in form, length, diameter, and in the materials of which they are composed,—under different Altitudes of water in the Reservoir.*

Altitude of the Water in the Reservoir. Ft.	In.	Lin.	Length of the Conduit Pipe. Feet.	Diameter of the Conduit Pipes. Lines.	Nature, Position, and Form, of the Conduit Pipes.	Ratio between the Quantities which would be discharged if the Fluid experienced no resistance in the pipes, and the Quantities actually discharged:—or the Ratio between the initial and the final Velocities of the Fluid.
0	4	0	50	12	Rectilineal and horizontal pipe of lead,	1 to 0.281
1	0	0	50	12	The same pipe similarly placed,	1 to 0.305
0	4	0	50	12	The same pipe with several horizontal flexures,	1 to 0.264
1	0	0	50	12	Same pipe,	1 to 0.291
0	4	0	50	12	The same pipe with several vertical flexures,	1 to 0.254
1	0	0	50	12	Same pipe,	1 to 0.290
1	0	0	180	16	Rectilineal and horizontal pipe of white iron,	1 to 0.166
2	0	0	180	16	Same pipe,	1 to 0.177
1	0	0	180	24	Rectilineal and horizontal pipe of white iron,	1 to 0.218
2	0	0	180	24	Same pipe,	1 to 0.234
20	11	0	177	16	Rectilineal pipe of white iron, and inclined so that CF (fig. 73.) is to F*f* as 2124 is to 241.	1 to 0.2000
13	4	8	118	16	Rectilineal pipe of white iron, and inclined like the last,	1 to 0.2500
6	8	4	159	16	Rectilineal pipe of white iron, and inclined like the last,	1 to 0.354
0	9	0	1782	48	Conduit pipe almost entirely of iron, with several flexures both horizontal and vertical,	1 to 0.350
1	9	0	1782	48	Same pipe,	1 to 0.0376
2	7	0	1782	48	Same pipe,	1 to 0.0387
0	3	0	1710	72	Conduit pipe almost entirely of iron, with several flexures both horizontal and vertical,	1 to 0.0809
0	5	3	1710	72	Same pipe,	1 to 0.0878
0	5	7	7020	60	Conduit pipe, partly stone and partly lead, with several flexures both horizontal and vertical,	1 to 0.0432
0	11	4	7020	60	Same pipe,	1 to 0.0476
1	4	9	7020	60	Same pipe,	1 to 0.0513
1	9	1	7020	60	Same pipe,	1 to 0.0532
2	1	0	7020	60	Same pipe,	1 to 0.0541
12	1	3	3600	144	Conduit pipe of iron, with flexures both horizontal and vertical,	1 to 0.0992
12	1	3	3600	216	Conduit pipe of iron, with several flexures both horizontal and vertical,	1 to 0.1653
4	7	6	4740	216	Conduit pipe of iron, with several flexures both horizontal and vertical,	1 to 0.0989
20	3	0	14040	144	Conduit pipe of iron, with several flexures both horizontal and vertical,	1 to 0.0517

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254. In order to shew the application of the preceding results, let us suppose that a spring, or a number of springs combined, furnishes 40,000 cubic inches of water in one minute; and that it is required to conduct it to a given place 4 feet below the level of the spring, and so situated that the length of the pipe must be 2400 feet. It appears from Table VI. art. 226, that the quantity of water furnished in a minute by a short cylindrical tube, when the altitude of the fluid in the reservoir is 4 feet, is 7070 cubic inches; and since the quantities furnished by two cylindrical pipes under the same altitude of water are as the squares of their diameters, we shall have by the following analogy the diameter of the tube necessary for discharging 40,000 cubic inches in a minute; $\sqrt{70720} : \sqrt{40000} = 12$ lines or 1 inch : $28.\frac{1}{2}$ lines, the diameter required. But by comparing some of the experiments in the preceding table, it appears that, when the length of the pipe is nearly 2400 feet, it will admit only about one-eighth of the water, that is, about 5000 cubic inches. That the pipe, however, may transmit the whole 40,000 cubic inches, its diameter must be increased. The following analogy, therefore, will furnish us with this new diameter; $\sqrt{5000} : \sqrt{40000} = 28.54$ lines : 80.73 lines, or 6 inches $8\frac{7}{10}$ lines, the diameter of the pipe which will discharge 40,000 cubic inches of water when its length is 2400 feet.

255. The following experiments were made by M. Bossut of Mezières in October 1779; and they are highly interesting, as they were made on the water discharged from the public and private fountains of that city.

Experiments on the Motion of Fluids.

TABLE XVI. *Containing Bossut's Experiments on the Quantities of Water discharged by different Pipes of various Lengths, and with different Adjutages, at the public and private Fountains of Mezières.*

Head of Water.		Length of Pipe.	Diameter of Pipe.	Size of Orifice.	Ratio of the Real to the Theoretical Discharges.	Ratio of the Height due to the Velocity to the Head of Water.	Cubic Inches of Water discharged in a Minute.
Feet.	In.	Feet.	Lines.	Lines.			
24	7	161	12	$7\frac{1}{2}$	0.045	0.002	242
23	9	192	12	$5\frac{1}{2}$	0.075	0.006	230
19	3	193	12	$6\frac{1}{4}$	0.068	0.005	222
19	9	188	12	$6\frac{1}{2}$	0.061	0.004	237
19	10	146	12	$2\frac{1}{3}$ by 7	0.089	0.008	168
29	1	187	15	$7\frac{1}{2}$ by $5\frac{1}{2}$	0.105	0.011	588
8	0	1069	18	Two adjutages, each 6 lines	0.435	0.189	1686
24	7	278	15	$3\frac{1}{2}$	0.396	0.157	458
32	7	314	15	Two adjutages, having each 5 lines	0.227	0.052	1232
30	5	446	18	2 by $6\frac{1}{2}$	0.037	0.001	636
26	3	506	18	4	0.447	0.200	696
27	0	668	18	$5\frac{1}{2}$	0.301	0.091	900
30	0	812	18	11	0.048	0.002	600
10	5	194	12	5	0.377	0.139	576
10	11	462	12	$5\frac{1}{2}$	0.332	0.109	576
10	0	420	15	7	0.163	0.028	483

Experiments on the pressure sustained by pipes.

SECT. VI. *Experiments on the Pressure exerted upon Pipes by the water which flows through them.*

256. The pressure exerted upon the sides of conduit pipes by the included water has been already investigated theoretically in Prop. X. Part II. The only way of ascertaining by experiment the magnitude of this lateral pressure is to make an orifice in the side of the pipe, and find the quantity of water which it discharges in a given time. This lateral pressure is the force which impels the water through the orifice; and therefore the quantity discharged, or the effect produced, must be always proportional to that pressure as its producing cause, and may be employed to represent it. The following table, founded on the experiments of Bossut, contains the quantities of water discharged from a lateral orifice about $3\frac{1}{4}$ lines in diameter, according to theory and experiment.

TABLE XVII. *Containing the Quantities discharged by a Lateral Orifice, or the Pressures on the Sides of Pipes, according to Theory and Experiment.*

Altitude of the Water in the Reservoir.	Length of the Conduit Pipe.	Quantities of Water discharged in 1 Minute, according to Theory.	Quantities of Water discharged in 1 Minute, according to Experiment.
Feet.	Feet.	Cubic Inches.	Cubic Inches.
1	30	176	171
1	60	186	186
1	90	190	190
1	120	191	191
1	150	192	193
1	180	193	194
2	30	244	240
2	60	259	256
2	90	264	261
2	120	267	264
2	150	268	265
2	180	269	266

It appears from the preceding table, that the real lateral pressure in conduit pipes differs very little from that which is computed from the formula; but in order that this accordance may take place, the orifice must be so perforated, that its circumference is exactly perpendicular to the direction of the water, otherwise a portion of the water dis-xperi-ents on Motion Fluids.

charged would be owing to the direct motion of the included fluid.

257. As pipes are exposed to forces besides those arising from the included water, they must be made much stronger than the preceding experiments would seem to require. The thicknesses of iron and leaden pipes used in France in the time of Bossut, are given in the following table.

Iron Pipes.		Leaden Pipes.	
Diameter.	Thickness.	Diameter.	Thickness.
Inches.	Lines.	Inches.	Lines.
1	1	1	$2\frac{1}{2}$
2	3	$1\frac{1}{2}$	3
4	4	2	4
6	5	3	5
8	6	$4\frac{1}{2}$	6
10	7	6	7
12	8	7	8

Sect. VII. *Experiments on the Motion of Water in Canals.*

Experiments on the Motion of Fluids.

Experiments on the velocity of water in horizontal canals.

258. Among the numerous experiments which have been made on this important subject, those of the Abbé Bossut seem entitled to the greatest confidence. His experiments were made on a rectangular canal 105 feet long, 5 inches broad at the bottom, and from 8 to 9 inches deep. The orifice which transmitted the water from the reservoir into the canal was rectangular, having its horizontal base constantly five inches, and its vertical height sometimes half an inch, and at other times an inch. The sides of this orifice were made of copper, and rising perpendicularly from the side of the reservoir, they formed two vertical planes parallel to each other. This projecting orifice was fitted into the canal, which was divided into 5 equal parts of 21 feet each, and also into 3 equal parts of 35, and the time was noted which the water employed in reaching these points of division. The arrival of the water at these points was indicated by the motion of a very small water wheel placed at each, and impelled by the stream. When the canal was horizontal, the following results were obtained.

Table XVIII. *Containing the Velocity of Water in a Rectangular Horizontal Canal* 105 *feet long, under different Altitudes of Fluid in the Reservoir.*

Altitude of the water in the reservoir.	Ft. In. 11 8	Ft. In. 7 8	Ft. In. 3 8	Ft. In. 11 8	Ft. In. 7 8	Ft. In. 3 8	Space run through by the water.
Vertical breadth of the orifice.	$\frac{1}{2}$ an inch.	$\frac{1}{2}$ an inch.	$\frac{1}{2}$ an inch.	1 inch.	1 inch.	1 inch.	Feet.
Time in which the number of feet in column seventh are run through by the water.	2″	3″—	3″+	2″	2″+	3″—	21
	5—	7	9	4	5	6+	42
	10—	13—	17+	7	9	11+	63
	16—	20—	27+	11	14	18+	84
	23+	28+	38+	$16\frac{1}{4}$	20	26	105

Deductions from the foregoing experiments.

259. It appears from column 1st, that the times successively employed to run through spaces of 21 feet each, are as the numbers 2, 3—, 5, 6, 7+, which form nearly an arithmetical progression, whose terms differ nearly by 1, so that by continuing the progression we may determine very nearly the time in which the fluid would run through any number of feet not contained in the 7th column. The same may be done with the other columns of the table.

If we compute theoretically the time which the water should employ in running through the whole length of the canal, or 105 feet, we shall find, that under the circumstances for each column of the preceding table the times, reckoning from the first column, are 6″.350, 7″.834, 11″.330, 6″.350, 7″.834, 11″.330. It appears, therefore, by comparing these times with those found by experiment, that the velocity of the stream is very much retarded by friction, and that this retardation is less as the breadth of the orifice is increased; for since a greater quantity of water issues in this case from the reservoir, it has more power to overcome the obstacles which obstruct its progress. The signs + and — affixed to the numbers in the preceding table, indicate that these numbers are a little too great or too small.

Experiments on the velocity of water in inclined canals.

260. The following experiments were made on inclined canals with different declivities, and will be of great use to the engineer. The inclination of the canal is the vertical distance of one of its extremities from a horizontal line which passes through its other extremity.

Experiments on the Motion of Fluids.

Table of the velocity of water in rectangular inclined canals.

TABLE XIX. *Containing the Velocity of Water in a Rectangular inclined Canal* 105 *Feet long, and under different Altitudes of Fluid in the Reservoir.*

Altitude of water in the reservoir.	*Ft.* *In.* 11 8	*Ft.* *In.* 7 8	*Ft.* *In.* 3 8	*Ft.* *In.* 11 8	*Ft.* *In.* 7 8	*Ft.* *In.* 3 8	Space run through by the water.
Inclination of the canal.	*Ft.* *In.* 0 3	*Ft.* *In.* 0 3	*Ft.* *In.* 0 3	*Ft.* *In.* 0 6	*Ft.* *In.* 0 6	*Ft.* *In.* 0 6	*Feet.*
Height of the orifice ½ an inch.	4″ 11+ 22	4″+ 14 + 26	6″+ 18 + 34 +	3″½ 11½ 21	4+ 14 25+	6 18— 31+	35 70 105
Inclination of the canal.	*Ft.* *In.* 0 6	*Ft.* *In.* 0 6	*Ft.* *In.* 0 6	*Ft.* *In.* 1 0	*Ft.* *In.* 1 0	*Ft.* *In.* 1 0	
Height of the orifice 1 inch.	3″ 8 15	4″— 9 + 19 —	5″— 13 — 23 —	3″— 7½ 14	4″— 9 16	5— 12 21	35 70 105
Inclination of the canal.	*Ft.* *In.* 2 0	*Ft.* *In.* 2 0	*Ft.* *In.* 2 0	*Ft.* *In.* 4 0	*Ft.* *In.* 4 0	*Ft.* *In.* 4 0	
Height of the orifice 1 inch.	2″+ 7 13	4″— 9 — 15 —	4″ 10½ 17½	2″+ 6½ 12	3″+ 8 13	4+ 9+ 15+	35 70 105
Inclination of the canal.	*Ft.* *In.* 6 0	*Ft.* *In.* 6 0	*Ft.* *In.* 6 0	*Ft.* *In.* 9 0	*Ft.* *In.* 9 0	*Ft.* *In.* 9 0	
Height of the orifice 1 inch.	2″+ 6 10	3″ 7+ 12	4″ 9— 14—	2″+ 6— 9	3″+ 6½ 10	4″— 8— 12	35 70 105
Inclination of the canal.	*Feet.* 11	*Feet.* 11	*Feet.* 11	*Feet.* 11	*Feet.* 11	*Feet.* 11	
In the 3 first columns the height of the orifice was ½ an inch, and in the 3 last 1 inch.	*Half sec.* 2+ 7 12 17 21+	*Half sec.* 3+ 8+ 13+ 18+ 23+	*Half sec.* 4+ 10 16 22 28	*Half see.* 2 5 9 13 17	*Half sec.* 3+ 7 11 15 19	*Half sec.* 3 8 13 18— 22	21 42 63 84 105
Inclination of the canal.	*Feet.* 11	*Feet.* 11	*Feet.* 11				
Height of the orifice 1½ inch.	*Half sec.* 2 5 8+ 12 15+	*Half sec.* 3— 6 10— 13+ 17	*Half sec.* 3+ 7 11+ 15 20				21 42 63 84 105
	Time in which the number of feet in the last col. is run through by the water.						

The velocity of the first portion of water that issues from the reservoir is less than that of the established current.

261. In the preceding experiments, the velocity of the first portion of water that issues from the reservoir was only observed; but when the current is once established, and its velocity permanent, it moves with greater rapidity, and there is always a fixed proportion between the velocity of the first portion of water and the permanent velocity of the established current. The cause of this difference Bossut does not seem to have thoroughly comprehended, when he ascribes it to a diminution of friction when the velocity becomes permanent. The velocity of the first portion of water that issues from the reservoir was measured by its arrival at certain divisions of the canal, consequently the velocity thus determined was the *mean* velocity of the water. The velocity of the established current, on the contrary, was measured by light bodies floating upon its surface, at the centre of the canal, therefore the velocity thus determined was the *superficial* velocity of the stream. But the velocity of the superficial central filaments must be greatest of all, because, being at the greatest distance from the sides and bottom of the canal, they are less affected by friction than any of the adjacent or inferior filaments, and are not retarded by the weight of any superincumbent fluid. The *superficial* velocity of the current must, of consequence, be greater than its *mean* velocity, or, in other words, the velocity of the established current must exceed the velocity of the first portion of water. The following table contains the experiments of Bossut on this subject, the canal being of the same size as in the former experiments, but 600 feet long, and its inclination one-tenth of the whole, or 59.702 feet.

xperi-ents on Motion Fluids.

Table XX. *Containing a Comparison between the Velocity of the First Portion of Water, and that of the Established Current.*

Altitude of the water in the reservoir.		Vertical breadth of the orifice 1 inch.		Vertical breadth of the orifice 2 inches.		Space run through by the water.
		Vel. of 1st portion of water.	Vel. of established current.	Vel. of 1st portion of water.	Vel. of established current.	
Ft.	In.	Seconds.	Seconds.	Seconds.	Seconds.	Feet.
4	0	10	8	8	7	100
4	0	20 +	17	17	14½	200
4	0	31 —	26	26	22	300
4	0	42 —	35	35 —	29 +	400
4	0	52½	43 +	43 +	37 —	500
4	0	62 +	52	52 —	44 +	600
2	0	11	10	9	8 —	100
2	0	23	20	19	16	200
2	0	35	30	29	24	300
2	0	46 +	40	39	32	400
2	0	58	49	49	40	500
2	0	69	58	58	48	600
1	0	12 +	12	15	13	100
1	0	25½	23 +	31	26½	200
1	0	39	33	47	39½	300
0	6	11 —	9	13½	11½	100
0	6	22	18 —	26¾	23	200
0	6	32	27	39½	33½	300

Sect. VIII. *On the Influence of Heat on the Motion of Fluids.*

Experiments on the Motion of Fluids.

The common theory of the motion of fluids defective in not considering the temperature of the water employed.

262. In all the experiments related in this chapter, and in those of the Chevalier Buat, which are given in the article Water-*Works*, the temperature of the water employed has never been taken into consideration. That the fluidity of water is increased by heat can scarcely admit of a doubt. Professor Leslie, in his ingenious paper on Capillary Action, has proved by experiment that a jet of warm water will spring much higher than a jet of cold water, and that a syphon which discharges cold water only by drops, will discharge water of a high temperature in a continued stream. A similar fact was observed by the ancients. Plutarch[1], in particular, assures us, that the clepsydræ or water clocks went slower in winter than in summer, and he seems to attribute this retardation to a diminution of fluidity. It is therefore obvious, that warm water will issue from an aperture with greater velocity than cold water, and that the quantities of fluid discharged from the same orifice, and under the same pressure, will increase with the temperature of the fluid. Hence we may discover the cause of the great discrepancy between the experiments of different philosophers on the motion of fluids. Their experiments were performed in different climates and at different seasons of the year; and, as the temperature of the water would be variable from these and from other causes, a variation in their results was the inevitable consequence.

Warm water moves faster than cold water.

Experiments of De Buat.

263. M. de Buat and M. Girard are the only persons who have made experiments on this interesting subject. M. de Buat employed in his experiments tubes of a large diameter, and hence the effects of heat were not very conspicuous. The following table contains a general view of the results which he obtained:

Table XXI. *Containing Du Buat's Experiments on the Motion of different Fluids, at different degrees of Temperature, in Tubes of Glass.*

Names of the Fluids.	Diameter and length of the Pipe.	Head of Water above the top of the tube.	Height of the expense in a minute expressed in inches.	Velocity in a second in inches.	Degrees of Heat above the freezing point.
Rain water	Horizontal tube 2.9 lines, or 0.24166 of an inch in diameter, and 36.25 inches long .	2.0833	5.2777	13.057	3
Salt water		2.0833	5.1666	12.7823	3
Salt water		2.0833	5.2222	12.9197	11
Salt water		4.9166	9.25	22.8845	10 to 11
Alcohol		5.0000	7.5833	18.7611	12
Mercury		0.8124	3.75	9.2775	10 to 12
Mercury		0.9166	4.0833	10.1021	10 to 12
Mercury		2.1944	6.6111	16.3558	10 to 12
Rain water	Horizontal tube 2 lines, or 0.16666 of an inch in diameter, and 36.25 inches long .	8.875	5.2777	27.455	55
Rain water		15.2916	6.9166	35.980	30
Rain water		15.2916	7.0833	36.847	36
Rain water		15.2916	7.2013	37.461	56
Alcohol		5.292	2.50	13.005	12
Alcohol		5.875	3.8338	19.941	12
Mercury		1.125	1.75	9.103	10 to 12
Mercury		2.7082	3.00	15.606	10 to 12
Mercury		5.1666	4.25	22.108	10 to 12
Mercury		0.0555	0.0000	0.000	10 to 12
Alcohol .	Horizontal tube 1½ line in diameter, and 34.16666 inches long	9.292	1.125	10.402	12

[1] Ελαυνѕσα γαρ ἡ ψυχροτης το ὑδωρ ποιει βαρυ και σωματῶδες, ὡς ἐστιν ἐν ταις κλεψυδραις καταμαθειν, βραδιον γαρ ἑλκѕσι χειμωνος ἡ θερѕς. *Aquam enim impellens frigus gravem facit et crassum, quod in clepsydris licet observare ; tardius enim trahunt hyeme quam æstate.*

Plutarch, *Quæst. Natural.*

Hence our author concludes that the velocity of water diminishes as its temperature approaches to that of the freezing point, and *vice versa;* that salt water has a less velocity than rain water, that alcohol runs slower than water, and mercury more rapidly.

Experiments of Girard.

264. The general result of M. Girard's experiments has been already given in the History of HYDRODYNAMICS. His experiments were made with copper tubes of exactly the same internal diameter, and drawn upon steel maundrils; and he employed two sets of these tubes of different diameters. The first set consisted of tubes, whose length was *two* decimeters, and diameter 2.96 millimetres, and they screwed into each other so as to form tubes of various lengths, from 20 to 222 centimetres. The second set consisted of smaller tubes, whose diameter was 1.83 millimetres. These tubes were then fixed horizontally in the sides of a reservoir, which was a cylinder of white iron 25 centimetres in diameter, and 5 decimetres high. The reservoir was kept full by the usual contrivances; and the water discharged by the tube subjected to trial, was received into a copper vessel horizontally, whose capacity had been accurately ascertained. The filling of the vessel was indicated by the instant when the water which it contained had wetted equally a plate of glass which covered almost the whole of its surface, and the time employed to fill this vessel was measured with great accuracy. The temperature of the water was also carefully noted. The results thus obtained amounted to 1200, and were arranged by M. Girard into thirty-four tables, according to the different circumstances of the experiment. When the capillary tube has such a length, that the term proportional to the square of the velocity disappears in the general formula, the velocity with which the fluid is discharged, is affected in a very singular manner by a variation of temperature. If the velocity is expressed by 10, when the temperature is 0° of the centigrade thermometer, the velocity will be so great as 42; or increased more than four times when the temperature amounts to 85° centigrade. When the length of the capillary tube is below the above mentioned limit, a variation of temperature exercises but a slight influence upon the velocity of the issuing fluid. If the length of the adjutage, for example, is 55 millimetres, and if the velocity is represented by 10 at 5° of the centigrade thermometer, it will be represented only by 12 at a temperature of 87°. In conduit pipes of the ordinary diameter, a change of temperature produces almost no perceptible change in the velocity of efflux. M. Girard also found, that the quantity of water discharged by capillary tubes, varied not only with the fluids which were used, but with the nature of the solid substance of which the tubes were composed.

On the Resistance of Fluids.

CHAPTER III.—ON THE RESISTANCE OF FLUIDS.

Reference to the article RESISTANCE *of Fluids.*

265. In the article RESISTANCE *of Fluids*, the reader will find that important subject treated at great length. The researches of preceding philosophers are there given in full detail; their different theories are compared with experiments, and the defects of these minutely considered. Since that article was composed, this intricate subject has been investigated by other writers, and though they have not enriched the science of hydraulics with a legitimate theory of the resistance of fluids, the results of their labours cannot fail to be interesting to every philosopher.

Researches of Coulomb.

266. The celebrated Coulomb has very successfully employed the principle of torsion, to determine the cohesion of fluids, and the laws of their resistance in very slow motions. His experiments are new, and were performed with the greatest accuracy; and the results which he obtained were perfectly conformable to the deductions of theory. We shall therefore endeavour to give the reader some idea of the discoveries which he has made.

267. When a body is struck by a fluid with a velocity exceeding eight or nine inches per second, the resistance has been found proportional to the square of the velocity, whether the body in motion strikes the fluid at rest, or the body is struck by the moving fluid. But when the velocity is so slow as not to exceed four-tenths of an inch in a second, the resistance is represented by two terms, one of which is proportional to the simple velocity, and the other to the square of the velocity. The first of these sources of resistance arises from the cohesion of the fluid particles which separate from one another, the number of particles thus separated being proportional to the velocity of the body. The other cause of resistance is the inertia of the particles, which, when struck by the fluid, acquire a certain degree of velocity proportional to the velocity of the body; and as the number of these particles is also proportional to that velocity, the resistance generated by their inertia must be proportional to the square of the velocity.

Opinions Newton, Bernoull & Grave ende.

268. When Sir Isaac Newton[1] was determining the resistance which the air opposed to the oscillatory motion of a globe in small oscillations, he employed a formula of three terms, one of them varying as the quare of the velocity, the second as the $\frac{3}{2}$ power of the velocity, and the third as the simple velocity; and in another part of the work he reduces the formula to two terms, one of which is as the square of the velocity, and the other constant. D. Bernoulli[2] also supposes the resistance to be represented by two terms, one as the square of the velocity, and the other constant. M. Gravesende[3] has found that the pressure of a fluid in motion against a body at rest, is partly proportional to the simple velocity, and partly to the square of the velocity. But when the body moves in a fluid at rest, he found[4] the resistance proportional to the square of the velocity, and to a constant quantity. When the *body in motion, therefore, meets the fluid at rest*, these three philosophers have agreed, that the formula which represents the resistance of fluids consists of two terms, one of which is as the square of the velocity, and the other constant. The experiments of Coulomb, however, incontestably prove, that the pressure which the moving body in this case sustains, is represented by two terms, one proportional to the simple velocity, and the other to its square, and that if there is a constant quantity, it is so very small as to escape detection.

Appara employ in Coulomb's perime Fig. 7

269. In order to apply the principle of torsion to the resistance of fluids, M. Coulomb made use of the apparatus represented in fig. 76. On the horizontal arm LK, which may be supported by a vertical stand, is fixed the small circle *fe*, perforated in the centre, so as to admit the cylindrical pin *ba*. Into a slit in the extremity of this pin is fastened, by means of a screw, the brass wire *ag*, whose force of torsion is to be compared with the resistance of the fluid; and its lower extremity is fixed in the same way into a cylinder of copper *gd*, whose diameter is about four tenths of an inch. The cylinder *gd* is perpendicular to the disc DS, whose circumference is divided into 480 equal

[1] *Principia*, lib. ii. prop. xl.
[2] *Comment. Pretropol.* tom. iii. and v.
[3] *Elements of Natural Philosophy*, art. 1911.
[4] *Ib.* art. 1975.

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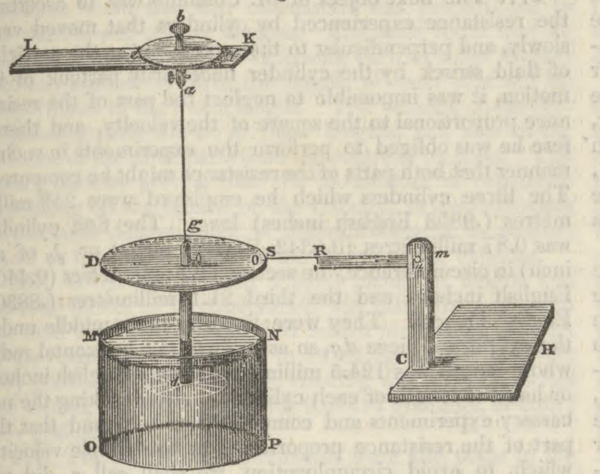
parts. When this horizontal disc is at rest, which happens when the torsion of the brass wire is nothing, the fixed index

Fig. 76.



RS is placed upon the point 0, the zero of the circular scale. The small rule Rm may be elevated or depressed at pleasure round its axis n, and the stand GH which supports it may be brought into any position round the horizontal disc. The lower extremity of the cylinder gd is immersed about two inches in the vessel of water MNOP, and to the extremity d is attached the planes, or the bodies whose resistance is to be determined when they oscillate in the fluid by the torsion of the brass wire. In order to produce these oscillations, the disc DS, supported by both hands, must be turned gently round to a certain distance from the index, without deranging the vertical position of the suspended wire. The disc is then left to itself; the force of torsion causes it to oscillate, and the successive diminutions of these oscillations are carefully observed. A simple formula gives in weights the force of torsion that produces the oscillations; and another formula well known to geometers, determines (by an approximation sufficiently accurate in practice), by means of the successive diminution of the oscillations compared with their amplitude, what is the law of the resistance, relative to the velocity, which produces these diminutions.

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270. The method employed by Coulomb, in reducing his experiments, is similar to that adopted by Newton and other mathematicians, when they wished to determine the resistance of fluids, from the successive diminutions of the oscillations of a pendulum moving in a resisting medium; but is much better fitted for detecting the small quantities which are to be estimated in such researches. When the pendulum is employed, the specific gravity of the body, relative to that of the fluid, must be determined; and the least error in this point leads to very uncertain results. When the pendulum is in different points of the arc in which it oscillates, the wire or pendulum rod is plunged more or less in the fluid; and the alterations which may result from this are frequently more considerable than the small quantities which are the object of research. It is only in small oscillations, too, that the force which brings the pendulum from the vertical, is proportional to the angle which the pendulum rod, in different positions, forms with this vertical line; a condition which is necessary before the formulæ can be applied. But small oscillations are attended with great disadvantages; and their successive diminutions cannot be determined but by quantities which it is difficult to estimate exactly, and which are changed by the smallest motion either of the fluid in the vessel, or of the air in the chamber. In small velocities, the pendulum rod experiences a greater resistance at the point of floatation than at any other part. This resistance, too, is very changeable; for the water rises from its level along the pendulum rod to greater or less heights, according to the velocity of the pendulum.

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On the Resistance of Fluids.

Advantages of comparing the resistance of fluids with the force of torsion.

271. These and other inconveniences which might be mentioned, are so inseparable from the use of the pendulum, that Newton and Bernoulli have not been able to determine the laws of the resistance of fluids in very slow motions. When the resistance of fluids is compared with the force of torsion, these disadvantages do not exist. The body is in this case entirely immersed in the fluid; and as every point of its surface oscillates in a horizontal plane, the relation between the densities of the fluid and the oscillating body has no influence whatever on the moving force. One or two circles of amplitude may be given to the oscillations; and their duration may be increased at pleasure, either by diminishing the diameter of the wire, or increasing its length; or, which may be more convenient, by augmenting the momentum of the horizontal disc. Coulomb, however, found that when each oscillation was so long as to continue about 100 seconds, the least motion of the fluid, or the tremor occasioned by the passing of a carriage, produced a sensible alteration on the results. The oscillations best fitted for experiments of this kind, continued from 20 to 30 seconds, and the amplitude of those that gave the most regular results, was comprehended between 480 degrees, the entire division of the disc, and 8 or 10 divisions reckoned from the zero of the scale. From these observations, it will be readily seen, that it is only in very slow motions that an oscillating body can be employed for determining the resistance of fluids. In small oscillations, or in quick circular motions, the fluid struck by the body is continually in motion; and when the oscillating body returns to its former position, its velocity is either increased or retarded by the motion communicated to the fluid, and not extinguished.

When the velocity is very small, the part of the resistance proportional to the square of the velocity disappears.

272. In the first set of experiments made by Coulomb, he attached to the lower extremity of the cylinder gd a circular plate of white iron, about 195 millimetres in diameter, and made it move so slowly, that the part of the resistance proportional to the square of the velocity wholly disappeared. For if, in any particular case, the portion of the resistance proportional to the simple velocity should be equal to the portion that is proportional to the square of the velocity when the body has a velocity of one-tenth of an inch per second, then, when the velocity is 100-tenths of an inch per second, the part proportional to the square of the velocity will be a hundred times greater than that proportional to the simple velocity; but if the velocity is only the hundredth part of the tenth of an inch per second, then the part proportional to the simple velocity will be 100 times greater than the part proportional to the square of the velocity.

Result of Coulomb's experiments on the resistance of water to a horizontal plate moving round its centre in the plane of its superficies.

273. When the oscillations of the white iron plate were so slow, that the part of the resistance which varies with the second power of the velocity was greatly inferior to the other part, he found, from a variety of experiments, that the resistance which diminished the oscillations of the horizontal plate was uniformly proportional to the simple velocity, and that the other part of the resistance, which follows the ratio of the square of the velocity, produced no sensible change upon the motion of the white iron disc. He also found, in conformity with theory, that the momenta of resistance in different circular plates moving round their centre in a fluid, are as the fourth power of the diameters of these circles; and that, when a circle of 195 millimetres (6.677 English inches) in diameter, moved round its centre in water, so that its circumference had a velocity of 140 millimetres (5.512 English inches) per second, the momentum of resistance which the fluid opposed to its circular motion was equal to one-tenth of a

On the Resistance of Fluids.

gramme (1.544 English troy grains) placed at the end of a lever 143 millimetres (5.63 English inches) in length.

Similar result obtained in clarified oil.

274. M. Coulomb repeated the same experiments in a vessel of clarified oil, at the temperature of 16 degrees of Reaumur. He found, as before, that the momenta of the resistance of different circular discs, moving round their centre in the plane of their superficies, were as the fourth power of their diameters; and that the difficulty with which the same horizontal plate, moving with the same velocity, separated the particles of oil, was to the difficulty with which it separated the particles of water, as 17.5 to 1, which is therefore the ratio that the mutual cohesion of the particles of oil has to the mutual cohesion of the particles of water.

Ratio between the mutual cohesion of the particles of oil, and the mutual cohesion of the particles of water.

The resistance not influenced by the nature of the surface of the moving body.

275. In order to ascertain whether or not the resistance of a body moving in a fluid was influenced by the nature of its surface, M. Coulomb anointed the surface of the white iron plate with tallow, and wiped it partly away, so that the thickness of the plate might not be sensibly increased. The plate was then made to oscillate in water, and the oscillations were found to diminish in the same manner as before the application of the unguent. Over the surface of the tallow upon the plate, he afterwards scattered, by means of a sieve, a quantity of coarse sand which adhered to the greasy surface; but when the plate, thus prepared, was caused to oscillate, the augmentation of resistance was so small, that it could scarcely be appreciated. We may therefore conclude, that the part of the resistance which is proportional to the simple velocity, is owing to the mutual adhesion of the particles of the fluid, and not to the adhesion of these particles to the surface of the body.

Experiments for finding if the resistance is increased by increasing the superincumbent fluid.

276. If the part of the resistance varying with the simple velocity were increased when the white iron plate was immersed at greater depths in the water, we might suppose it to be owing to the friction of the water on the horizontal surface, which, like the friction of solid bodies, should be proportional to the superincumbent pressure. In order to settle this point, M. Coulomb made the white iron plate oscillate at the depth of two centimetres (.787 English inches), and also at the depth of 50 centimetres (19.6855 English inches), and found no difference in the resistance; but as the surface of the water was loaded with the whole weight of the atmosphere, and as an additional load of 50 centimetres of water could scarcely produce a perceptible augmentation of the resistance, M. Coulomb employed another method of deciding the question. Having placed a vessel full of water under the receiver of an air-pump, the receiver being furnished with a rod and collar of leather at its top, he fixed to the hook, at the end of the rod, a harpsichord wire, number 7 in commerce, and suspended to it a cylinder of copper, like gd, fig. 76, which plunged in the water of the vessel, and under this cylinder he fixed a circular plane, whose diameter was 101 millimetres (3.976 English inches). When the oscillations were finished, and consequently the force of torsion nothing, the zero of torsion was marked by the aid of an index fixed to the cylinder. The rod was then made to turn quickly round through a complete circle, which gave to the wire a complete circle of torsion, and the successive diminutions of the oscillations were carefully observed. The diminution for a complete circle of torsion was found to be nearly a fourth part of the circle for the first oscillation, but always the same whether the experiment was made in a vacuum or in the atmosphere. A small pallet 50 millimètres long (1.969 English inches), and 10 millimètres broad (0.3937 English inches), which struck the water perpendicular to its plane, furnished a similar result. We may therefore conclude, that when a submerged body moves in a fluid, the pressure which it sustains, measured by the altitude of the superior fluid, does not perceptibly increase the resistance; and consequently, that the part of this resistance proportional to the simple velocity, can in no respect be compared with the friction of solid bodies, which is always proportional to the pressure.

On the Resistan[ce] of Flui[ds.]

On the re[]sistance [of] cylinder[s] moving perpend[i]cular to their ax[es.]

277. The next object of M. Coulomb was to ascertain the resistance experienced by cylinders that moved very slowly, and perpendicular to their axes; but as the particles of fluid struck by the cylinder necessarily partook of its motion, it was impossible to neglect the part of the resistance proportional to the square of the velocity, and therefore he was obliged to perform the experiments in such a manner that both parts of the resistance might be computed. The three cylinders which he employed were 249 millimetres (.9803 English inches) long. The first cylinder was 0.87 millimètres (0.0342 English inches or $\frac{1}{29}$ of an inch) in circumference, the second 11.2 millimètres (0.4409 English inches), and the third 21.1 millimètres (.88307 English inches). They were fixed by their middle under the cylindrical piece dg, so as to form two horizontal radii, whose length was 124.5 millimètres (.4901 English inches) or half the length of each cylinder. After making the necessary experiments and computations, he found that the part of the resistance proportional to the simple velocity, which, to avoid circumlocution, we shall call r, did not vary with the circumferences of the cylinders. The circumferences of the first and third cylinders were to one another as 24 : 1, whereas the resistances were in the ratio of 3 : 1. The same conclusion was deduced by comparing the experiments made with the first and second cylinder.

The res[ist]ance du[e to] the sim[ple] velocity not pro[por]tional t[o] the circ[um]ference[s of] the cyli[n]ders.

Cause [of] this.

278. In order to explain these results, M. Coulomb very justly supposes, that, in consequence of the mutual adhesion of the particles of water, the motion of the cylinder is communicated to the particles at a small distance from it. The particles which touch the cylinder have the same velocity as the cylinder, those at a greater distance have a less velocity, and at the distance of about one-tenth of an inch the velocity ceases entirely, so that it is only at that distance from the cylinder that the mutual adhesion of the fluid molecules ceases to influence the resistance. The resistance r therefore should not be proportional to the circumference of the real cylinder, but to the circumference of a cylinder whose radius is greater than the real cylinder by one-tenth of an inch. It consequently becomes a matter of importance to determine with accuracy the quantity which must be added to the real cylinder in order to have the radius of the cylinder to which the resistance r is proportional, and from which it must be computed. Coulomb found the quantity by which the radius should be increased to be 1.5 millimetres ($\frac{59}{1000}$ of an English inch), so that the diameter of the augmented cylinder will exceed the diameter of the real cylinder by double that quantity, or $\frac{118}{1000}$ of an inch.

The re[sist]ance d[ue to] the *sim[ple] velocity* propor[tion]al to t[he] circum[fe]rence [of] the cyl[in]ders w[hen] their r[adii] are au[g]mente[d] $\frac{59}{1000}$ o[f an] inch.

The re[sist]ance d[ue to] the *sq[uare] of the* [velo]*city* is [pro]portio[nal] to the [cir]cumfe[r]ences [of] the cy[lin]ders w[hen] their r[adii] are au[g]mente[d] $\frac{11}{1000}$ o[f an] inch.

279. The part of the resistance varying with the square of the velocity, or that arising from the inertia of the fluid, which we shall call R, was likewise not proportional to the circumferences of the cylinder; but the augmentation of the radii amounts in this case only to $\frac{11}{1000}$ of an inch, which is only one-fifth of the augmentation necessary for finding the resistance r. The reason of this difference is obvious; all the particles of the fluid when they are separated from each other oppose the same resistance, whatever be their velocity; consequently as the value of r depends only on the adhesion of the particles, the resistances due to this adhesion will reach to the distance from the cylinder where the velocity of the particles is 0. In comparing the different values of R, the part of the resistance which varies as the square of the velocity, all the particles are supposed to have a velocity equal to that of the cylinder; but as it is only the particles which touch the cylinder that have this velocity, it follows that the augmentation of the diameter necessary for finding R must be less than the augmentation necessary for finding r.

Cause [of] this di[ffer]ence.

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280. In determining experimentally the part of the momentum of resistance proportional to the velocity, by two cylinders of the same diameter, but of different lengths, M. Coulomb found that this momentum was proportional to the third power of their lengths. The same result may be deduced from theory; for supposing each cylinder divided into any number of parts, the length of each part will be proportional to the whole length. The velocity of the corresponding parts will be as these lengths, and also as the distance of the same parts from the centre of rotation. The theory likewise proves, that the momentum of resistance depending on the square of the velocity, in two cylinders of the same diameter but of different lengths, is proportional to the fourth power of the length of the cylinder.

resist- of a cy- r.

281. When the cylinder 0.9803 inches in length, and 0.04409 inches in circumference, was made to oscillate in the fluid with a velocity of 5.51 inches per second, the part of the resistance r was equal to 58 milligrammes, or .8932 troy grains. And when the velocity was 0.3937 inches per second, the resistance r was 0.00414 grammes, or 0.637 troy grains.

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282. The preceding experiments were also made in the oil formerly mentioned; and it likewise appeared, from their results, that the mutual adhesion of the particles of oil was to the mutual adhesion of the particles of water as 17 to 1. But though this be the case, M. Coulomb discovered that the quantity by which the radii of the cylinder must be augmented in order to have the resistance r, is the very same as when the cylinder oscillated in water. This result was very unexpected, as the greater adhesion between the particles of oil might have led us to anticipate a much greater augmentation. When the cylinders oscillated both in oil and water with the same velocity, the part of the resistance R produced by the inertia of the fluid particles which the cylinder put in motion, was almost the same in both. As this part of the resistance depends on the quantity of particles put in motion, and not on their adhesion, the resistances due to the inertia of the particles will be in different fluids as their densities. On the Resistance of Fluids.

283. In a subsequent memoir, Coulomb proposes to determine numerically the part of the resistance proportional to the square of the velocity, and to ascertain the resistance of globes with plain, convex, and concave surfaces. He has found in general that the resistance of bodies not entirely immersed in the fluid is much greater than that of bodies which are wholly immersed; and he promises to make further experiments upon this point. We intended on the present occasion to have given the reader a more complete view of the researches of this ingenious philosopher; but these could not well be understood without a knowledge of his investigations respecting the force of torsion, which we have not yet had an opportunity of communicating. In the article MECHANICS, however, we shall introduce the reader to this interesting subject; and may afterwards have an opportunity of making him farther acquainted with those researches of Coulomb, of which we have at present given only a general view. Coulomb promises to extend his researches on the resistance of fluids.

284. The subject of the resistance of fluids has been recently treated by the learned Dr Hutton of Woolwich. His experiments were made in air with bodies of various forms, moving with different velocities, and inclined at various angles to the direction of their motion. The following table contains the results of many interesting experiments. The numbers in the ninth column represent the exponents of the power of the velocity which the resistances in the 8th column bear to each other. Researches of Dr Hutton.

TABLE I. *Shewing the Resistance of Hemispheres, Cones, Cylinders, and Globes, in different Positions, and moving with different Velocities.*

Velocity per second.	Small hemisphere, $4\frac{3}{4}$ inches dia. flat side.	Large hemisphere $6\frac{5}{8}$ inches diameter.		Cone $6\frac{5}{8}$ inches diameter.		Cylinder $6\frac{5}{8}$ inches diameter.	Globe $6\frac{5}{8}$ inches diameter.	Power of the vel. to which the resistance is proportional.
		Flat side.	Round side.	Vertex.	Base.			
Feet.	Oz. avoir.	Oz. avoir.	Oz. avoir.	Oz. avoir.	Oz. avoir.	Oz. avoir.	Oz. avoir.	
3	.028	.051	.020	.028	.064	.050	.027	
4	.048	.096	.039	.048	.109	.090	.047	
5	.072	.148	.063	.071	.162	.143	.068	
6	.103	.211	.092	.098	.225	.205	.094	
7	.141	.284	.123	.129	.298	.278	.125	
8	.184	.368	.160	.168	.382	.360	.162	
9	.233	.464	.199	.211	.478	.456	.205	
10	.287	.573	.242	.260	.587	.565	.255	
11	.349	.698	.292	.315	.712	.688	.310	2.052
12	.418	.836	.347	.376	.850	.826	.370	2.042
13	.492	.988	.409	.440	1.000	.979	.435	2.036
14	.573	1.154	.478	.512	1.166	1.145	.505	2.031
15	.661	1.336	.552	.589	1.346	1.327	.581	2.031
16	.754	1.538	.634	.673	1.546	1.526	.663	2.033
17	.853	1.757	.722	.762	1.763	1.745	.752	2.038
18	.959	1.928	.818	.858	2.002	1.986	.848	2.044
19	1.073	2.998	.921	.959	2.260	2.246	.949	2.047
20	1.196	2.542	1.033	1.069	2.540	2.528	1.057	2.051
Mean proportional numbers.	140	288	119	126	291	285	124	2.040
1	2	3	4	5	6	7	8	9

sults of pre- ing ex- iments.

285. From the preceding experiments we may draw the following conclusions: 1. That the resistance is nearly proportional to the surfaces, a small increase taking place when the surfaces and the velocities are great. 2. The resistance to the same surface moving with different velocities, is nearly as the square of the velocity; but it appears from

On the Resistance of Fluids.

the 9th column that the exponent increases with the velocity. 3. The round and sharp ends of solids sustain a greater resistance than the flat ends of the same diameter. 4. The resistance to the base of the hemisphere is to the resistance on the convex side, or the whole sphere, as $2\frac{1}{3}$, to 1, instead of 2 to 1, as given by theory. 5. The resistance on the base of the cone is to the resistance on the vertex nearly as $2\frac{3}{10}$ to 1; and in the same ratio is radius to the sine of half the angle at the vertex. Hence in this case the resistance is directly as the sine of the angle of incidence, the transverse section being the same. 6. The resistance of the base of a hemisphere, the base of a cone, and the base of a cylinder, are all different, though these bases be exactly equal and similar.

286. The following table contains the resistance sustained by a globe 1.965 inches in diameter. The fourth column is the quotient of the resistance by experiment, divided by the theoretical resistance.

Experiments with a Globe 1.965 inches in diameter.

TABLE II. *Containing the Resistance to a Globe 1.965 Inches in Diameter, moving with various Velocities, according to Theory and Experiment.*

Velocity of the Globe per second.	Resistance by experiment.	Resistance by theory.	Ratio between the experimental and theoretical resistance.	Power of the velocity to which the resistance is proportional.
Feet.	Oz. avoir.	Oz. avoir.		
5	0.006	0.005	1.20	
10	0.0245	0.020	1.23	
15	0.055	0.044	1.25	
20	0.100	0.079	1.27	
25	0.157	0.123	1.28	2.022
30	0.23	0.177	1.30	2.059
40	0.42	0.314	1.33	2.068
50	0.67	0.491	1.36	2.075
100	2.72	1.164	1.38	2.059
200	11	7.9	1.40	2.041
300	25	18.7	1.41	2.039
400	45	31.4	1.43	2.039
500	72	49	1.47	2.044
600	107	71	1.51	2.051
700	151	96	1.57	2.059
800	205	126	1.63	2.067
900	271	159	1.70	2.077
1000	350	196	1.78	2.086
1100	442	238	1.86	2.095
1200	546	283	1.90	2.102
1300	661	332	1.99	2.107
1400	785	385	2.04	2.111
1500	916	442	2.07	2.113
1600	1051	503	2.09	2.113
1700	1186	568	2.08	2.111
1800	1319	636	2.07	2.108
1900	1447	709	2.04	2.104
2000	1569	786	2.00	2.098
1	2	3	4	5

287. It appears from a comparison of the 2d, 3d, and 4th columns, that when the velocity is small, the resistance by experiment is nearly equal to that deduced from theory: but that as the velocity increases, the former gradually exceeds the latter till the velocity is 1300 feet per second, when it becomes twice as great. The difference between the two resistances then increases, and reaches its maximum between the velocities of 1600 and 1700 feet. It afterwards decreases gradually as the velocity increases, and at the velocity of 2000 the resistance by experiment is again double of the theoretical resistance. By considering the numbers in column 5th, it will be seen, that in slow motions the resistances are nearly as the square of the velocities; that this ratio increases gradually, though not regularly, till at the velocity of 1500 or 1600 feet it arrives at its maximum. It then gradually diminishes as the velocity increases.

Conclusions similar to these were deduced from experiments made with globes of a larger size.

288. The following table contains the resistance of a plane inclined at various angles, according to experiment, and according to a formula deduced from the experiments.

TABLE III. *Containing the Resistances to a plane inclined at various Angles to the Line of its Motion.*

Inclination of the plane.	Resistances by experiment.	Resistances by the formula $0.84s^{1,842}c$.	Sines of the angles to radius 840.
Degrees.	Oz. avoir.	Oz. avoir.	
0	.000	.000	.000
5	.015	.009	.073
10	.044	.035	.146
15	.082	.076	.217
20	.133	.131	.287
25	.200	.199	.355
30	.278	.278	.420
35	.362	.363	.482
40	.448	.450	.540
45	.534	.535	.594
50	.619	.613	.643
55	.684	.680	.688
60	.729	.736	.727
65	.770	.778	.761
70	.803	.808	.789
75	.823	.826	.811
80	.835	.836	.827
85	.839	.839	.838
90	.840	.840	.840
1	2	3	4

289. The plane with which the preceding experiments were performed was 32 square inches, and always moved with a velocity of 12 feet per second. The resistances which this plane experienced are contained in column 2d. From the numbers in that column Dr Hutton deduced the formula $.84s^{1.842}c$, where s is the sine, and c the cosine of the angles of inclination in the first column. The resistances computed from this formula are contained in column 3d, and agree very nearly with the resistances deduced from experiment. The 4th column contains the sines of the angles in the first column to a radius .84, in order to compare them with the resistances which have obviously no relation either to the sines of the angles or to any power of the sines. From the angle of 0 to about 60° the resistances are less than the sines; but from 60° to 90° they are somewhat greater.

Researches of Mr Vince.

290. The experiments of Mr Vince were made with bodies at a considerable depth below the surface of water; and he determined the resistance which they experienced, both when they moved in the fluid at rest, and when they received the impulse of the moving fluid. In the experiments contained in the following table, the body moved in the fluid with a velocity of 0.66 feet in a second. The angles at which the planes struck the fluid are contained in the first column. The second column shews the resist-

ance by experiment in the direction of their motion in troy ounces. The third column exhibits the resistance by theory, the perpendicular distance being supposed the same as by experiment. The fourth column shews the power of the sine of the angle to which the resistance is proportional, and was computed in the following manner. Let s be the sine of the angle, radius being 1, and r the resistance at that angle. Suppose r to vary as s^m, then we have $r^m : s^m = 0.2321 : r$; hence $s^m = \frac{1}{0.2321}$, and therefore $m = \frac{\text{Log. } r - \text{Log. } 0.2321}{\text{Log. } s}$, and by substituting their corresponding values, instead of r and s we shall have the values of m or the numbers in the fourth column.

TABLE IV. *Containing the resistance of a Plane Surface moving in a Fluid, and placed at different angles to the path of its motion.*

Angle of inclination.	Resistance by experiment.	Resistance by theory.	Power of the sine of the angle to which the resistance is proportional.
Degrees.	Troy ounces.	Troy ounces.	Experiments.
10	0.0112	0.0012	1.73
20	0.0364	0.0093	1.73
30	0.0769	0.0290	1.54
40	0.1174	0.0616	1.54
50	0.1552	0.1043	1.51
60	0.1902	0.1476	1.38
70	0.2125	0.1926	1.42
80	0.2237	0.2217	2.41
90	0.2321	0.2321	
1	2	3	4

291. According to the theory the resistance should vary as the cube of the sine, whereas from an angle of 90° it decreases in a less ratio, but not as any constant power, nor as any function of the sine and cosine. Hence the actual resistance always exceeds that which is deduced from theory, assuming the perpendicular resistance to be the same. The cause of this difference is partly owing to our theory neglecting that part of the force which after resolution acts parallel to the plane, but which, according to experiments, is really a part of the force which acts upon the plane.

On the Resistance of Fluids.

Experiments with hemispheres, globes, and cylinders.

292. Mr Vince made also a number of experiments on the resistance of hemispheres, globes, and cylinders, which moved with a velocity of 0.542 feet per second. He found that the resistance to the spherical side of a hemisphere was to the resistance on its base as 0.034 is to 0.08339; that the resistance of the flat side of a hemisphere was to the resistance of a cylinder of the same diameter, and moving with the same velocity, as 0.08339 is to 0.07998; and that the resistance to a complete globe is to the resistance of a cylinder of the same diameter, and with the same velocity, as 1 : 2.23.

Determination of the resistance when the body is struck by the moving fluid.

293. The following results were obtained, when the plane was struck by the moving fluid. The second column of the following table contains the resistance by experiment, and the third column the resistance by theory from the perpendicular force, supposing it to vary as the sine of the inclination.

TABLE V. *Containing the Resistance of a Plane struck by the Fluid in Motion, and inclined at different angles to the direction of its path.*

Angle of inclination.	Resistance by experiment.			Resistance by theory.		
Degrees.	Oz.	dwts.	grs.	Oz.	dwts.	grs.
90	1	17	12	1	17	12
80	1	17	0	1	16	22
70	1	15	12	1	15	6
60	1	12	12	1	12	11
50	1	18	10	1	18	17
40	1	4	10	1	4	2
30	0	18	18	0	18	18
20	0	12	12	0	12	19
10	0	6	4	0	6	12
1	2			3		

294. It appears from the preceding results, that the resistance varies as the sine of the angle at which the fluid strikes the plane, the difference between theory and experiment being such as might be expected from the necessary inaccuracy of the experiments.

By comparing the preceding table with Table IV., it will be found that the resistance of a plane moving in a fluid is to the resistance of the same plane when struck by the fluid in motion as 5 to 6. In both these cases the actual effect on the plane must be the same, and therefore, the difference in the resistance can arise only from the action of the fluid behind the body in the former case.

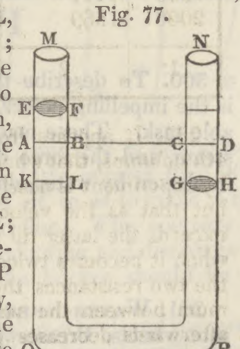
CHAPTER IV. ON THE OSCILLATION OF FLUIDS, AND THE UNDULATION OF WAVES.

PROP. I.

295. The oscillations of water in a syphon, consisting of two vertical branches and a horizontal one, are isochronous, and have the same duration as the oscillations of a pendulum, whose length is equal to half the length of the oscillating column of water.

Into the tube MNOP, having its internal diameter every where the same, introduce a quantity of water. When the water is in equilibrio, the two surfaces AB, CD will be in the same horizontal line AD. If this equilibrium be disturbed by making the syphon oscillate round the point y, the water will rise and fall alternately in the vertical branches after the syphon is at rest. Suppose the water to rise to EF in the branch MO, it will evidently fall to GH in the other branch, so that CG is equal to AE. Then it is evident, that the force which makes the water oscillate, is the weight of the column EFKL, which is double the column EABF; and that this force is to the whole weight of the water, as 2 AE is to AOPD. Now, let P be a pendulum, whose length is equal to half the length of the oscillating column AOPD, and which describes to the lowest point S arches PS, equal to AE; then 2 AE : AOPD = AE : QP, because AE is one-half of 2 AE, and QP one-half of AOPD. Consequently, since AOPD is a constant quantity, the force which makes the water oscillate is always proportional to the space which it runs through, and its oscillations are therefore isochronous. The force

Fig. 77.

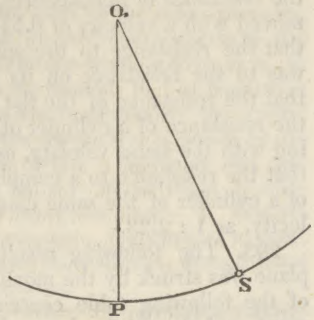


Oscillation of Fluids, &c.

Fig. 78.

which makes the pendulum describe the arch PS, is to the weight of the pendulum as PS is to PQ, or as AE is to PQ, since AE = PS ; but the force which makes the water oscillate, is to the weight of the whole water in the same ratio ; consequently, since the pendulum P, and the column AOPD, are influenced by the very same force, their oscillations must be performed in the same time. Q. E. D.

Fig. 78.



296. Cor. As the oscillations of water and of pendulums are regulated by the same laws, if the oscillating column of water is increased or diminished, the time in which the oscillations are performed will increase or diminish in the subduplicate ratio of the length of the pendulum.

Scholium.

297. This subject has been treated in a general manner, by Newton and different philosophers, who have shewn how to determine the time of an oscillation, whatever be the form of the syphon. See the *Principia*, lib. ii. Prop. 45, 46. Bossut's *Traité d'Hydrodynamique*, tom. 1. *Notes sur le Chap. II. Part II.* Bernoulli *Opera*, tom. iii. p. 125, and *Encyclopédie*, art. *Ondes*.

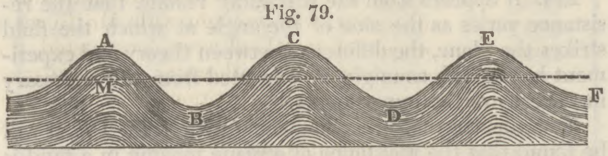
Prop. II.

On the undulation of waves.

298. The undulations of waves are performed in the same time as the oscillations of a pendulum whose length is equal to the breadth of a wave, or to the distance between two neighbouring cavities or eminences.

In the waves ABCDEF, the undulations are performed

Fig. 79.



in such a manner, that the highest parts ACE become the lowest ; and as the force which depresses the eminences ACE is always the weight of water contained in these eminences, it is obvious, that the undulations of waves are of the same kind as the undulations or oscillations of water in a syphon. It follows, therefore, from Prop. I. that if we take a pendulum, whose length is one-half BM, or half the distance between the highest and lowest parts of the wave, the highest parts of each wave will descend to the lowest parts during one oscillation of the pendulum, and in the time of another oscillation will again become the highest parts. The pendulum, therefore, will perform two oscillations in the time that each wave performs one undulation, that is, in the time that each wave describes the space AC or BD, between two neighbouring eminences or cavities, which is called *the breadth of the wave.* Now, if a pendulum, whose length is one-half BM, performs two oscillations in the above time, it will require a pendulum four times that length to perform only one oscillation in the same time, that is, a pendulum whose length is AC or BD, since $4 \times \frac{1}{2}$ BM = 2 BM = AC or BD. Q. E. D.

Scholium.

299. The explanation of the oscillation of waves contained in the two preceding propositions, was first given by Sir Isaac Newton, in his *Principia*, lib. ii. Prop. 44. He considered it only as an approximation to the truth, since it supposes the waves to rise and fall perpendicularly like the water in the vertical branches of the syphon, while their real motion is partly circular. The theory of Newton was, nevertheless, adopted by succeeding philosophers, and gave rise to many analogous discussions respecting the undulation of waves. Very lately, however, an attempt has been made by M. Flaugergues, to overturn the theory of Newton. From a number of experiments on the motion and figure of waves, an account of which may be seen in the *Journal des Sçavans*, for October 1789, M. Flaugergues concludes, that a wave is not the result of a motion in the particles of water, by which they ascend and descend alternately in a serpentine line, when moving from the place where the water received the shock ; but that it is an intumescence which this shock occasions around the place where it is received, by the depression that is there produced. This intumescence afterwards propagates itself circularly, while it removes from the place where the shock first raised it above the level of the stagnant water. A portion of the stagnant water then flows from all sides into the hollow formed at the place where the shock was received ; this hollow is thus heaped with fluid, and the water is elevated so as to produce all around another intumescence, or a new wave, which propagates itself circularly as before. The repetition of this effect produces on the surface of the water a number of concentric rings, successively elevated and depressed, which have the appearance of an undulatory motion. This interesting subject has also been discussed by M. La Grange, in his *Mécanique Analytique*, to which we must refer the reader for farther information. See History of Hydrodynamics, art. 21.

PART III.—ON HYDRAULIC MACHINERY.

Hydraulic machines.

300. To describe the various machines in which water is the impelling power, would be an endless and unprofitable task. Those machines which can be driven by wind, steam, and the force of men or horses, as well as they can be driven by water, do not properly belong to the science of hydraulics. By hydraulic machinery, therefore, we are to understand those various contrivances by which water can be employed as the impelling power of machinery ; and those machines which are employed to raise water, or which could not operate without the assistance of that fluid.

CHAPTER I. ON WATER-WHEELS.

Different kinds of water-wheels

301. Water-wheels are divided into three kinds, Overshot-wheels, Breast-wheels, and Undershot-wheels, which derive their names from the manner in which the water is delivered upon their circumferences.

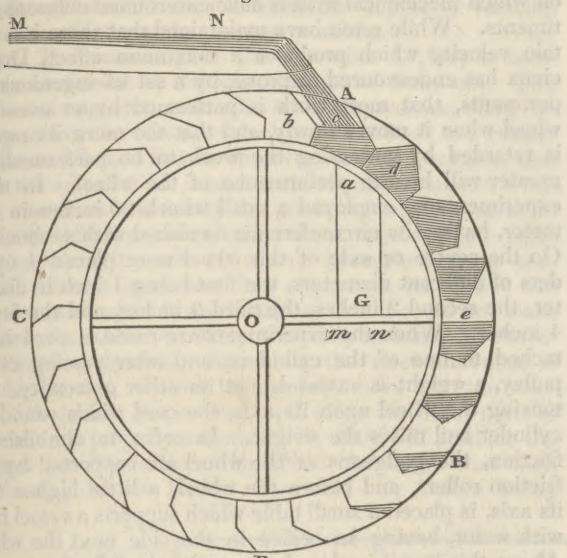
Sect. I. *On Overshot-Wheels.*

302. An overshot-wheel is a wheel driven by the weight of water, conveyed into buckets disposed on its circumfe-

On Water-Wheels.

rence. It is represented in fig. 80, where ABC is the circumference of the wheel furnished with a number of buck-

Fig. 80.



ets. The canal MN conveys the water into the second bucket from the top Aa. The equilibrium of the wheel is therefore destroyed; and the power of the bucket Aa, to turn the wheel round its centre of motion O, is the same as if the weight of the water in the bucket were suspended at m, the extremity of the lever Om, c being the centre of gravity of the bucket, and Om a perpendicular let fall from the fulcrum O to the direction cm, in which the force is exerted. In consequence of this destruction of equilibrium, the wheel will move round in the direction AB, the bucket Aa will be at d, and the empty bucket b will take the place of Aa, and receive water from the spout N. The force acting on the wheel is now the water in the bucket d acting with a lever nO, and the water in the bucket Aa acting with a lever mO. The velocity of the wheel will therefore increase with the number of loaded buckets, and with their distance from the vertex of the wheel; for the lever by which they tend to turn the wheel about its axis, increases as the buckets approach to c, where their power, represented by eO, is a maximum. After the buckets have passed e, the lever by which they act gradually diminishes, they lose by degrees a small portion of their water; and as soon as they reach B it is completely discharged. When the wheel begins to move, its velocity will increase rapidly till the quadrant of buckets be is completely filled. While these buckets are descending through the inferior quadrant eP, and the buckets on the left hand of b are receiving water from the spout, the velocity of the wheel will still increase; but the increments of velocity will be smaller and smaller, since the levers by which the inferior buckets act are gradually diminishing. As soon as the highest bucket Ac has reached the point B, where it is emptied, the whole semicircumference nearly of the wheel is loaded with water; and when the bucket at B is discharging its contents, the bucket at A is filling, so that the load in the buckets, by which the wheel is impelled, will be always the same, and the velocity of the wheel will become uniform.

Method of computing the momentum of water in the loaded arch.

303. In order to find the power of the loaded arch to turn the wheel, or, which is the same thing, to find a weight which, suspended at the opposite extremity C, will balance the loaded arch or keep it in equilibrio, we must multiply the weight of water in each bucket by the length of the virtual lever by which it acts, and take the sum of all these momenta for the momentum of the loaded arch. It will be much easier, however, and the result will be the same, if we multiply the weight of all the water on the arch AB, by the distance of its centre of gravity G, from the fulcrum or centre of motion O. Now, by the property of the centre of gravity (see MECHANICS), the distance of the centre of gravity of a circular arch from its centre, is a fourth proportional to half the arch, the radius, and the sine of half the arch. Since the vertical bucket b has no power to turn the wheel if it were filled, and since two or three buckets between B and P are always empty, we may safely suppose that the loaded arch never exceeds 160°, so that if R = radius of the wheel in feet, we shall have the length of half the loaded arch, or $80° = 2\,R \times 3.1416 \times \frac{80}{360} = R \times 1.396$; and the distance of the centre of gravity from the fulcrum O, $= GO = \frac{R \times \text{Sin. } 80°}{R \times 1.396}$. Now, if N be the number of buckets in the wheel, $\frac{160\,N}{360}$, or $\frac{4\,N}{9}$, will be the number of buckets in the loaded arch; and if G be the number of ale gallons contained in each bucket, the weight of the water in each bucket will be $1.02 \times G$, pounds avoirdupois. The weight of the water, therefore, in the loaded arch, will be $\frac{4\,N}{9} \times 102\ G$, and consequently the momentum of the loaded arch will be

$$= \frac{4\,N}{9} \times 10.2\,G \times \frac{R \times \text{Sin. } 80°}{R \times 1.396} = \frac{4\,N}{9} \times 10.2\,G \times 0.6338$$

$$= \frac{4\,N}{9} \times 6.465\ G \text{ pounds avoirdupois.}$$

Hence, we have the following rule: Multiply the constant number 6.465 by $\frac{4}{9}$ of the number of buckets in the wheel, and this product by the number of ale gallons in each bucket; and the result will be the effective weight, or momentum of the water in the loaded arch. For a description of the best form that can be given to the buckets, see the article *WATER-Works*. Dr Robison has there recommended a mode of constructing the buckets invented by Mr Burns, who divided each bucket into two by means of a partition; but the writer of this article is assured, on the authority of an ingenious mill-wright, who wrought with Mr Burns at the time when wheels of this kind were constructed, that the inner bucket is never filled with water, and that much of the power is thus lost. The partition prevents the introduction of the fluid, and the water is driven backwards by the escape of the included air.

304. In order to determine the best form of the buckets, we must consider that the power of the wheel would be a maximum, if the whole of its semi-circumference were loaded with water. This effect would be obtained if the buckets had the shape shewn in fig. 81., where ABC is the form of the bucket, AB being a continuation of the radius, and BC part of the circumference of the wheel, and nearly equal to AD. But as a small aperture at CE will neither admit nor discharge the water, the form shewn in fig. 82. has been proposed by Sir David Brewster as the best. In this construction, BC is made a little larger than BE, and AB is diminished so as to make the angle ABC a little greater than 90°. The angles AB should be rounded off, so as to make ABC a curve, as indicated by the dotted line. The aperture at dE must be sufficient for the introduction and discharge of the water, and the side BE of the bucket should be as smooth and even as possible.

Fig. 81.

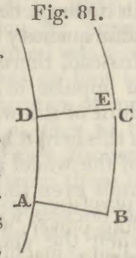
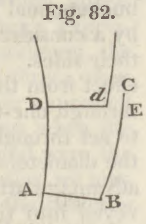


Fig. 82.

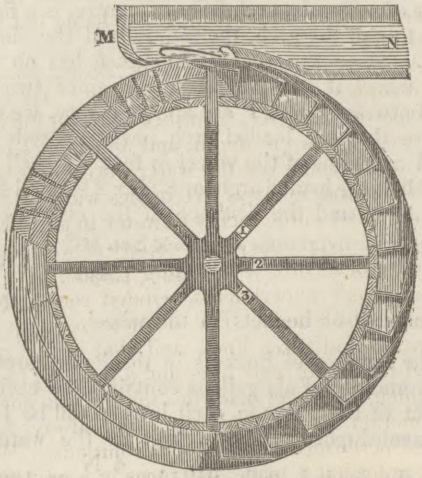


305. The construction of an overshot-wheel, and the mode of admitting the water into the buckets from the mill-course MN, is shewn in the following figure. In an overshot-

On Water-Wheels.

wheel constructed by Mr Smeaton, the wheel is exactly the height of the fall, and in another it exceeds that height, so as to be intermediate between an overshot and a breast wheel.

Fig. 83.



On the diameter of overshot-wheels relatively to the height of the fall.

306. In the construction of overshot-wheels, it is of great importance to determine what should be the diameter of the wheel relatively to the height of the fall. It is evident that its diameter cannot exceed the height of the fall. Some mechanical writers have demonstrated that, in theory, an overshot-wheel will produce a maximum effect when its diameter is two-thirds of that height, the water being supposed to fall into the buckets with the velocity of the wheel. But this rule is palpably erroneous, and directly repugnant to the results of experiment. For if the height of the fall be 48 feet, the diameter of the wheel will, according to this rule, be 32 feet; and the water having to fall through 16 feet before it reaches the buckets, will have a velocity of 32 feet per second, which, according to the hypothesis, must also be the velocity of the wheel's circumference. But Smeaton has proved, that a maximum effect is produced by an overshot-wheel of any diameter, when its velocity is only *three* feet per second. The Chevalier de Borda has shewn, that overshot-wheels will produce a maximum effect when their diameter is equal to the height of the fall; and this is completely confirmed by Mr Smeaton's experiments. From a great number of trials, Mr Smeaton has concluded, "that the higher the wheel is in proportion to the whole descent, the greater will be the effect." Nor is it difficult to assign the reason of this. The water which is conveyed into the buckets can produce very little effect by its impulse, even if its velocity be great; both on account of the obliquity with which it strikes the buckets, and in consequence of the loss of water occasioned by a considerable quantity of the fluid being dashed over their sides. Instead, therefore, of expecting an increase of effect from the impulse of the water occasioned by its fall through one-third of the whole height, we should allow it to act through this height by its gravity, and therefore make the diameter of the wheel as great as possible. But a disadvantage attends even this rule; for if the water is conveyed into the buckets without any velocity, which must be the case when the diameter of the wheel equals the height of the fall, the velocity of the wheel will be retarded by the impulse of the buckets against the water, and much power would be lost by the water dashing over them. In order, therefore, to avoid all inconveniences, the distance of the spout from the receiving bucket should, in general, be about two or three inches, that the water may be delivered with a velocity a little greater than that of the wheel; or, in other words, the diameter of an overshot-wheel should be two or three inches less than the greatest height of the fall; and yet it is no uncommon thing to see the diameters of these wheels scarcely one-half of that height. In such a construction the loss of power is prodigious.

On the proper velocity of overshot wheels. Experiments of Deparcieux on the velocity of overshot wheels.

307. The proper velocity of overshot-wheels is a subject on which mechanical writers have entertained different sentiments. While some have maintained that there is a certain velocity which produces a maximum effect, Deparcieux has endeavoured to prove, by a set of ingenious experiments, that most work is performed by an overshot-wheel when it moves slowly, and that the more its motion is retarded by increasing the work to be performed, the greater will be the performance of the wheel. In these experiments he employed a small wheel, 20 inches in diameter, having its circumference furnished with 48 buckets. On the centre or axle of this wheel were placed 4 cylinders of different diameters, the first being 1 inch in diameter, the second 2 inches, the third 3 inches, and the fourth 4 inches. When the experiments are made, a cord is attached to one of the cylinders, and after passing over a pulley, a weight is suspended at its other extremity. By moving the wheel upon its axis, the cord winds round the cylinder and raises the weight. In order to diminish the friction, the gudgeons of the wheel are supported by two friction rollers, and before the wheel, a little higher than its axis, is placed a small table which supports a vessel filled with water, having an orifice in the side next the wheel. Above this vessel is placed a large bottle full of water and inverted, having its mouth immersed a few lines in the water, so that it empties itself in proportion as the water in the vessel is discharged from the orifice. The quantity of water thus discharged is always the same, and is conveyed from the orifice by means of a canal to the buckets of the wheel. With this apparatus he obtained the following results.

Diameters of the Cylinders.	Altitude through which 12 ounces were elevated.		Altitude through which 24 ounces were elevated.	
Inches.	Inches.	Lines.	Inches.	Lines.
1	69	9	40	0
2	80	6	43	6
3	85	6	44	6
4	87	9	45	3

Result the preceding experiment.

308. When the large cylinders were used, the velocity of the wheel was smaller, because the resistances are proportional to their diameter, the weight being the same. Hence it appears, by comparing the four results in column 2d with one another, and also the four results in column 3d, that when the wheel turns more slowly, the effect, which is in this case measured by the elevation of the weight always increases. When the weight of 24 ounces was used, the resistance was twice as great, and the velocity twice as slow, as when the 12 ounce weight was employed. But by comparing the results in column 2d with the corresponding results in column 3d, it appears, that when the 24 ounce weight was employed, and the velocity was only one-half of what it was when the 12 ounce weight was used, the effect was *more than one-half*, the numbers in the 3d column being more than one-half the numbers in the 2d. Hence we may conclude, that the slower an overshot-wheel moves, the greater will be its performance.

An overshot-wheel does more work the slower it moves.

There is a velocity which gives a maximum effect.

309. These experiments of Deparcieux presented such unexpected results, as to induce other philosophers to examine them with care. The Chevalier D'Arcy, in particular, considered them attentively. He maintained that there was a determinate velocity when the effect of the wheel reached its maximum; and he has shewn, by comparing the experiments of Deparcieux with his own formulæ, that the overshot-wheel which Deparcieux employed never

On ater- W els.

moved with such a small velocity as corresponded with the maximum effect, and that if he had increased the diameter of his cylinders, or the magnitude of the weights, his own experiments would have exhibited the degree of velocity, when the effect was the greatest possible.

His pi- nio on- firm l by the peri- mei of Sm on;

310. The reasoning of the Chevalier D'Arcy is completely confirmed by the experiments of Smeaton. This celebrated engineer concludes with Deparcieux, that, *cæteris paribus*, the less the velocity of the wheel, the greater will be its effect. But he observes, on the contrary, that when the wheel of his model made about 30 turns in a minute, the effect was nearly the greatest; when it made 30 turns, the effect was diminished about one-twentieth part; and that when it made 40 it was diminished about one-fourth; when it made less than $18\frac{1}{4}$ turns, its motion was irregular, and when it was loaded so that it could not make 18 turns, the wheel was overpowered by its load. Mr Smeaton likewise observes, that when the circumferences of overshot-wheels, whether high or low, move with the velocity of three feet per second, and when the other parts of the work are properly adapted to it, they will produce the greatest possible effect. He allows, however, that high wheels may deviate farther from this rule before losing their power than low ones can be permitted to do; and assures us that he has seen a wheel 24 feet high moving at the rate of six feet per second, without losing any considerable part of its power, and likewise a wheel 33 feet high moving very steadily and well with a velocity but little exceeding two feet.

On Water-Wheels.

311. The experiments of the Abbé Bossut may also be adduced in support of the same reasoning. He employed a wheel 3 feet in diameter, furnished with 48 buckets, having each three inches of depth, and four inches of width. The canal which conveyed the water into the buckets was perfectly horizontal, and was five inches wide. It furnished uniformly 1194 cubic inches of water in a minute. The resistance to be overcome was a variety of weights fixed to the extremity of a cord, which, after passing over a pulley as in Deparcieux's experiments, winded round the cylindrical axle of the wheel. The diameter of this cylinder was two inches and seven lines, and that of the gudgeons or pivots of the wheel two lines and a half. The number of turns which the wheel made in a minute was not reckoned till its motion became uniform, which always happened when it had performed five or six revolutions. When the wheel was unloaded it made $40\frac{1}{4}$ turns in a minute.

And also by the experiments of Bossut.

Number of pounds raised.	Number of seconds in which the load was raised.	Number of revolutions performed by the wheel.	Effect of the wheel, or the product of the number of turns multiplied by the load.
11	60″	$11\frac{46}{48}$	$131\frac{32}{48}$
12	60	$11\frac{11}{48}$	$134\frac{36}{48}$
13	60	$10\frac{25}{48}$	$136\frac{37}{48}$
14	60	$9\frac{40}{48}$	$137\frac{32}{48}$
15	60	$9\frac{10}{48}$	$138\frac{6}{48}$
16	60	$8\frac{31}{48}$	$138\frac{16}{48}$
17	60	$8\frac{9}{48}$	$139\frac{9}{48}$
18	60	$7\frac{32}{48}$	138
19	The wheel turned but exceedingly slow.		
20	The wheel stopped though first put in motion by the hand to make it catch the water.		

312. It appears evidently from the last column, which we have computed on purpose, that the effect increases as the velocity diminishes; but that the effect is a maximum when the number of turns is $8\frac{9}{48}$ in a minute, being then $139\frac{9}{48}$. When the velocity was farther diminished by adding an additional pound to the resistance, the effect was diminished to 138, and when the velocity was still less, the wheel ceased to move.

Now since the wheel was three feet in diameter, and 9.42 feet in circumference, the velocity of its circumference will be about one foot four inches per second, when it performs $8\frac{9}{48}$ turns in a minute, or when the maximum effect is produced. With Mr Smeaton's model, the maximum effect was produced when the velocity of the wheel's circumference was two feet per second. So that the experiments both of Smeaton and Bossut concur to prove, that the power of overshot wheels increases as the velocity diminishes; but that there is a certain velocity, between one and two feet per second, when the wheel produces a maximum effect. Since when the wheel was unloaded it turned $40\frac{1}{4}$ times in a minute, and performed only $8\frac{9}{48}$ revolutions when its power was a maximum, the velocity of the wheel when unloaded will be to its velocity when the effect is the greatest, as five to one, nearly.

On the effect of overshot-wheels.

313. The Chevalier de Borda maintains that an overshot wheel will raise through the height of the fall a quantity of water equal to that by which it is driven, and Albert Euler has shewn that the effect of these wheels is very much inferior to the momentum or force which impels them. It appears, however, from Mr Smeaton's experiments, that when the work performed was a maximum, the ratio of the power to the effect was as four to three, when the height of the fall and the quantities of water expended were the least; but that it was as four to two when the heights of the fall and the quantities discharged were the greatest. By taking a mean between these ratios, we may conclude, in general, that in overshot-wheels the power is to the effect as three to one. In this case the power is supposed to be computed from the whole height of the fall; because the water must be raised to that height in order to be in a condition of producing the same effect a second time. When the power of the water is estimated only from the height of the wheel, the ratio of the power to the effect was more constant, being nearly as five to four.

Investigation of Albert Euler.

314. The theory of overshot-wheels has been ably discussed by Albert Euler and Lambert. The former of these philosophers has shewn that the altitude of the wheel should be made as great as possible; that the buckets should be made as capacious as other circumstances will permit; that their form should be such as to convey the

On Water-Wheels.

water as near the lowest point of the wheel as can be conveniently done; and that the motion of the wheel should be slow, that the buckets may be completely filled. He has likewise shewn that the effect of the wheel increases as its velocity is diminished; and that overshot-wheels should be used only when there is a sufficient height of fall. The results of Lambert's investigations are less consonant with the experiments of Smeaton. By examining the following table, which contains these results, it will appear at once that he makes the diameter of the wheel much smaller than it ought to be.

Table for Overshot-Mills.

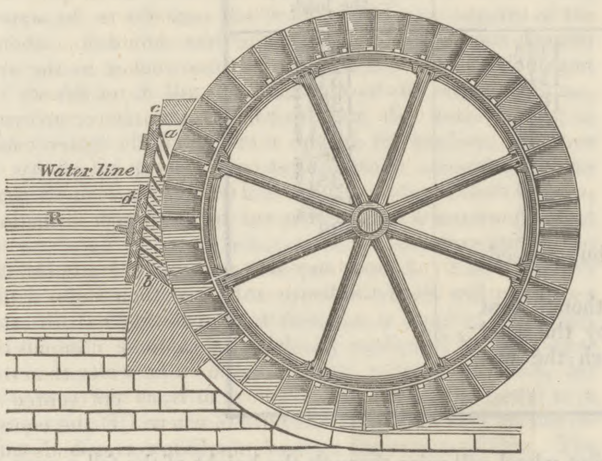
Height of the fall reckoning from the surface of the stream.	Radius of the wheel reckoning from the extremity of the buckets.	Width of the buckets.	Depth of the buckets.	Velocity of the wheel per second.	Time in which the wheel performs one revolution.	Turns of the millstone for one of the wheel.	Force of the water upon the buckets.	The length of mn in Fig. 80.	The length of no in Fig. 80.	Quantity of water required per second to turn the wheel.
Feet.	Feet.	Feet.	Feet.	Feet.	Seconds.		Lb. avoir.	Feet.	Feet.	Cub. Feet.
7	2.83	1.00	2.02	5.27	3.38	8.45	636	0.33	1.15	10.55
8	3.22	1.14	1.44	5.63	3.61	9.02	595	0.38	1.32	9.23
9	3.63	1.27	1.07	5.94	3.83	9.57	565	0.42	1.48	8.21
10	4.04	0.43	0.82	6.30	4.04	10.10	531	0.48	1.65	7.38
11	4.45	0.57	0.65	6.60	4.23	10.57	511	0.52	1.81	6.71
12	4.86	0.71	0.52	6.89	4.42	11.05	486	0.57	1.98	6.15
1	2	3	4	5	6	7	8	9	10	11

Sect. II. *On Breast-Wheels.*

Description of breast-wheels.

315. A breast-wheel partakes of the nature both of an overshot and an undershot wheel, and is driven partly by

Fig. 84.



the impulse, but chiefly by the weight, of the water. The mill-course (fig. 84), is made concentric with the wheel, which is fitted to it in such a manner that no water is allowed to escape at the sides and extremities of the floatboards. The water is delivered into the openings of the wheel through an iron grating ab, and its admission is regulated by two shutters c, d, the lowest of which is adjusted till a sufficient quantity of water passes over it; and the other shutter c is made to descend by machinery when the wheel is to be stopped, and the water retained in the reservoir R. According to Mr Smeaton, the effect of a wheel driven in this manner is equal "to the effect of an undershot-wheel whose head of water is equal to the difference of level between the surface of water in the reservoir, and the point where it strikes the wheel, added to that of an overshot whose height is equal to the difference of level between the point where it strikes the wheel and the level of the tail water."[1]

316. Mr Lambert, of the Academy of Sciences at Berlin, observes,[2] that a breast-wheel should be used when the fall of water is above four feet in height, and below ten. The following table is calculated from Lambert's formulæ, and exhibits at one view the results of his investigations.

Table for Breast-Mills.

Height of the fall in feet.	Breadth of the floatboards.	Depth of the floatboards.	Radius of the water-wheel reckoned from the extremity of the floatboards.	Velocity of the wheel per second.	Time in which the wheel performs one revolution.	Turns of the millstone for one of the wheel.	Force of the water upon the floatboards.	The length of $m\,n$, in fig. 84.	The length of $n\,o$, in fig. 84.	Water required per second to turn the wheel.
	Feet.	Feet.	Feet.	Feet.	Seconds.		Lb. avoir.	Feet.	Feet.	Cub. Feet.
1	0.17	198.6	0.75	2.18	1.92	4.80	1536	0.08	0.23	74.30
2	0.34	35.1	1.50	3.09	2.72	6.80	1084	0.15	0.46	37.15
3	0.51	12.7	2.26	3.78	3.33	8.32	886	0.23	0.68	24.77
4	0.69	6.2	3.01	4.36	3.84	9.60	768	0.30	0.91	18.57
5	0.86	3.57	3.76	4.88	4.28	10.70	686	0.38	1.14	14.86
6	1.03	2.25	4.51	5.35	4.70	11.76	626	0.46	1.37	12.38
7	1.20	1.53	5.26	5.77	5.08	12.70	581	0.53	1.60	10.61
8	1.37	1.10	6.02	6.17	5.43	13.58	543	0.60	1.83	9.29
9	1.54	0.81	6.77	6.55	5.76	14.40	512	0.68	2.05	8.26
10	1.71	0.77	7.52	6.90	6.07	15.18	486	0.76	2.28	7.43
1	2	3	4	5	6	7	8	9	10	11

[1] *Smeaton on Mills*, schol. p. 36.

[2] *Nouv. Mém. de l'Académie de Berlin*, 1775, p. 71.

On Water-Wheels.

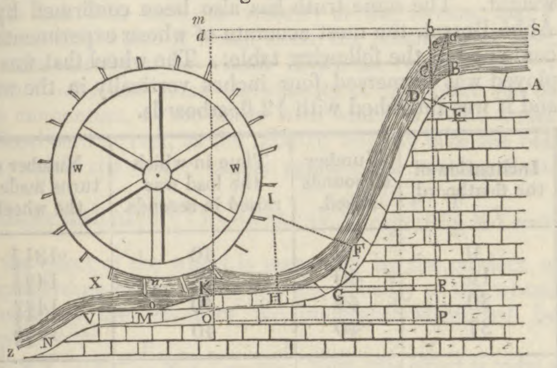
317. It appears from the preceding table, that when the altitude of the fall of water is below three feet, there is such an unsuitable proportion between the depth and width of the floatboards, that a breast wheel cannot well be employed. It is also evident, on the other hand, that when the height of the fall approaches to ten feet, the depth of the floatboards is too small in relation to their width. These two extremes, therefore, ought to be avoided in practice. The eleventh column of the table contains the quantity of water necessary to drive the wheel; but the total quantity of water should always exceed this, by the quantity, at least, that escapes between the mill-course and the sides and extremities of the floatboards.[1]

Sect. III. *On Undershot-Wheels.*

Description of an undershot wheel.

318. An undershot-wheel is a wheel with a number of floatboards disposed on its circumference, which receive the impulse of the water conveyed to the lowest point of the wheel by an inclined canal. It is represented in fig. 85, where WW is the water-wheel, and ABDFHKMV the

Fig. 85.



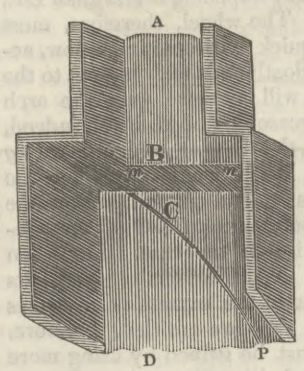
canal or mill-course, which conveys the water to K, where it strikes the plane floatboards *no*, &c. and makes the wheel revolve about its axis.

Construction of the mill-course.

319. In order to construct the mill-course to the greatest advantage, we must give but a very small declivity to the canal which conducts the water from the river. It will be sufficient to make AB slope about one inch in 200 yards, making the declivity, however, about half an inch for the first 48 yards, in order that the water may have sufficient velocity to prevent it from falling back into the river. The inclination of the fall, represented by the angle GCR, should be 25° 50′, or CR, the radius, should be to GR, the tangent of this angle, as 100 to 28, or as 25 to 12; and since the surface of the water S*b* is bent from *ab* into *ac* before it is precipitated down the fall, it will be necessary to incurvate the upper part BCD of the course into BD, that the water in the bottom may move parallel to the water at the surface of the stream. For this purpose take the points B, D about 12 inches distance from C, and raise the perpendiculars BE, DE. The point of intersection E will be the centre from which the arch BD is to be described; the radius being about $10\frac{1}{10}$ inches. Now, in order that the water may act more advantageously upon the floatboards of the wheel WW, it must assume a horizontal direction, with the same velocity which it would have acquired when it came to the point G. But, if the water were allowed to fall from C to G, it would dash upon the horizontal part HG, and thus lose a great part of its velocity. It will be necessary, therefore, to make it move along FH, an arch of a circle to which DF and KH are tangents in the points F and H. For this purpose make GF and GH each equal to three feet; and raise the perpendiculars HI, FI which will intersect one another in the point I, distant about four feet nine inches from the points F and H, and the centre of the arch FH will be determined. The distance HK, through which the water runs before it acts upon the wheel, should not be less than two or three feet, in order that the different filaments of the fluid may have attained a horizontal direction. If HK were too large, the stream would suffer a diminution of velocity by its friction on the bottom of the course. That no water may escape between the bottom of the course KH and the extremities of the floatboards, KL should be about three inches, and the extremity *o* of the floatboard *no* ought to reach below the line HKX, sufficient room being left between *o* and M for the play of the wheel; or KLM may be formed into the arch of a circle KM concentric with the wheel. The line LMV, which has been called the course of impulsion, should be prolonged so as to support the water as long as it can act upon the floatboards, and should be about nine inches distant from OP, a horizontal line passing through O the lowest point of the fall; for if OL were much less than nine inches, the water having spent the greatest part of its force in impelling the floatboard, would accumulate below the wheel, and retard its motion. For the same reason another course, which has been called the course ot discharge, should be connected with LMV by the curve VN, to preserve the remaining velocity of the water, which would otherwise be discharged by falling perpendicularly from V to N. The course of discharge, which is represented by the line VZ, sloping from the point O, should be about 16 yards long, having an inch of declivity for every two yards. The canal which reconducts the water from the course of discharge to the river should slope about four inches in the first 200 yards, three inches in the second 200 yards, decreasing gradually till it terminates in the river. But if the river to which the water is conveyed should, when swelled by the rains, force the water back upon the wheel, the canal must have a greater declivity to prevent this from taking place. Hence it is evident that very accurate levelling is requisite to the proper formation of the mill-course.

As it is of great importance that none of the water should escape, either below the floatboards or at their sides, without contributing to turn the wheel, the course of impulsion KV should be wider than the course at K, as represented in fig. 86, where CD the course of impulsion corresponds with LV in fig. 85, AB corresponds with HK, and BC with KL. The breadth of the floatboards, therefore, should be wider than *mn*, and their extremities should reach a little below B, like *no* in fig. 85. When these precautions are properly taken, no water can escape without exerting its force upon the floatboards.

Fig. 86.



On the number of floatboards in undershot-wheels.

320. It has been disputed among philosophers, whether the wheel should be furnished with a small or a great number of floatboards. M. Pitot has shewn, that when the floatboards have different degrees of obliquity, the force of impulsion upon the different surfaces will be reciprocally as their breadths: Thus in fig. 87, the force of impulsion upon *he* will be to the force upon DO, as DO to *he*.[2] Hence he concludes that the distance between the floatboards should be equal to one-half of the immersed arch, or that when one floatboard is at the bottom of the wheel, and perpendi-

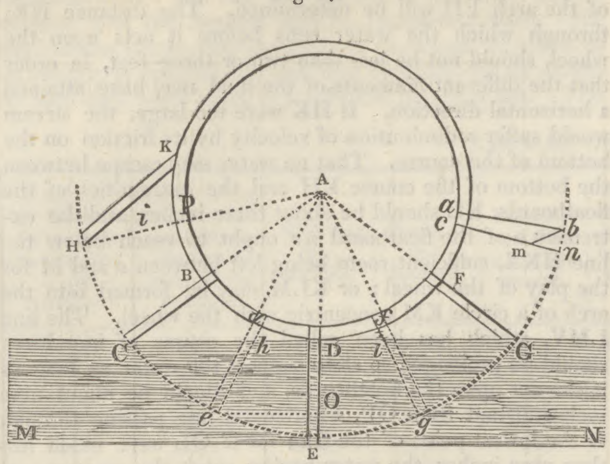
[1] See *Appendix to Ferguson's Lectures*, vol. ii. p. 189, 2d edit.

[2] *Mém. del' Académie Paris*, 1729, 8vo. p. 359.

On Water-Wheels.

cular to the current, as DE, the preceding floatboard BC

Fig. 87.



should be just leaving the stream, and the succeeding one FG just immerging into it. For when the three floatboards FG, DE, BC have the same position as in the figure, the whole force of the current NM will act upon DE when it is in the most advantageous position for receiving it, whereas, if another floatboard *de* were inserted between FG and DE, the part *ig* would cover DO, and by thus substituting an oblique for a perpendicular surface, the effect would be diminished in the proportion of DO to *ig*. Hence it is evident, that, upon this principle, the depth of the floatboard DE should be always equal to the versed sine of the arch EG.[1]

Rule given by Pitot,

proved to be inaccurate.

321. Notwithstanding the plausibility of this reasoning, it will not be difficult to shew that it is destitute of foundation. It is evident from fig 87, that when one of the floatboards DE is perpendicular to the stream, it receives the whole impulse of the water in the most advantageous manner. But when it arrives at the position *de*, and the succeeding one FG at the position *fg*, so that the angle *e* A *g* may be bisected by the perpendicular AE, the situation of these floatboards will be the most disadvantageous, for a great part of the water will escape between the extremities *g* and *e* of the floatboards without striking them, and the part *ig* of the floatboards, which is really impelled, is less than DE, and oblique to the current. The wheel, therefore, must move irregularly, sometimes quick and sometimes slow, according to the position of the floatboards with respect to the stream; and this inequality will increase with the arch plunged in the water. The reasoning of M. Pitot, indeed, is founded on the supposition, that if another floatboard *fg* were placed between FG and DF, it would annihilate the force of the water that impels it, and prevent any of the fluid from striking the corresponding part DO of the preceding floatboard. But this is not the case. For when the water has acted upon *fg*, it still retains a part of its motion, and after bending round the extremity *g*, strikes DE with its remaining force. We are entitled, therefore, to conclude that advantage must be gained by using more floatboards than are recommended by Pitot.

The number of the floatboards should be as great as possible.

322. It is evident from the preceding remarks, that in order to remove any inequality of motion in the wheel, and prevent the water from escaping below the extremities of the floatboards, the wheel should be furnished with the greatest possible nnmber of floatboards, without loading it too much, or enfeebling the rim on which they are fixed. This rule was first given by M. Dupetit Vandin;[2] and it is easily perceived, that if the mill-wright should err in using too many floatboards, this error in excess will be perfectly trifling, and that a much greater loss of power would be occasioned by an error in defect.

On Wa- Whee-

Form of the floa- boards.

323. The section of the floatboards ought not to be rectangular, like *a b n c* in fig. 87, but should be bevelled like *a b m c*. For if they were rectangular, the extremity *b n* would interrupt a portion of the water which would otherwise fall on the corresponding part of the preceding floatboard. In order to find the angle *a b m*, subtract from 180 degrees the number of degrees contained in the immersed arch CEG, and the half of the remainder will be the angle required.

Positio- the floa- boards.

324. It has been maintained by M. Pitot and other philosophers, that the floatboards should be a continuation of the radius, or perpendicular to the rim, as in fig. 85. This, indeed, is true in theory, but it appears from the most unquestionable experiments, that they should be inclined to the radius. This important fact was discovered by Deparcieux in 1753, and proved by several experiments. When the floatboards are inclined, the water heaps up on their surface, and acts not only by its impulse, but also by its weight. The same truth has also been confirmed by the Abbé Bossut, the most accurate of whose experiments are contained in the following table. The wheel that was employed was immersed four inches vertically in the water, and it was furnished with 12 floatboards.

Inclination of the floatboard.	Number of pounds raised.	Time in which the load was raised in seconds.	Number of turns made by the wheel.
0	40	40	$13\frac{17}{48}$
15	40	40	$14\frac{21}{48}$
30	40	40	$14\frac{22}{48}$
37	40	40	$14\frac{15}{48}$
1	2	3	4

325. It is obvious, from the preceding table, that the wheel made the greatest number of turns, or moved with the greatest velocity, when the number of floatboards was between 15 and 30. When the water-wheels are placed on canals that have little declivity, and in which the water can escape freely after its impulse upon the floatboards, it would be proper to make the floatboards a continuation of the radius. But when they move in an inclined mill-course, an augmentation of velocity may be expected from an inclination of the floatboards.

On th- proper- locity under- wheel- when effect maxim-

326. Having thus pointed out the most scientific method of constructing the wheel, and delivering the water upon its floatboards, we have now to determine the velocity with which it should move. It is evident that the velocity of the wheel must be always less than that of the water which impels it, even when there is no work to be performed; for a part of the impelling power is necessarily spent in overcoming the inertia of the wheel, and the resistance of friction. It is likewise obvious, that when the wheel has little or no velocity, its performance will be very trifling. There is, consequently, a certain proportion between the velocity of the water and the wheel, when its effect is a maximum. By the reasoning which is employed in the section on undershot-wheels in the article WATER-WORKS, Parent and Pitot found, that a maximum effect was produced when the velocity of the wheel was one-third of the velocity of the water; and Desaguliers,[3] Maclaurin,[4] Lambert,[5] and Atwood,[6] have adopted their conclusions.

[1] A table containing the number of floatboards for wheels of different diameters, and founded on this principle, has been given in the *Appendix to Ferguson's Lectures*, vol. ii. p. 149, 2d edit.

[2] *Mémoires des Sçavans Etrangers*, tom. i.

[3] Desaguliers' Experimental Philosophy, vol. ii. p. 424, lect. 12.

[4] Atwood on Rectilineal and Rotatory Motion, p. 275–284.

[5] Maclaurin's Fluxions, Art. 907, p. 728.

[6] *Nouv. Mémoires de l'Acad. Berlin*, 1775, p. 63.

On Water-Wheels.

In the calculus from which this result was deduced, it was taken for granted that the momentum or force of water upon the wheel is in the duplicate ratio of the relative velocity, or as the square of the difference between the velocity of the water and that of the wheel. This supposition, indeed, is perfectly correct when the water impels a single floatboard; for as the number of particles which strike the floatboard in a given time, and also the momentum of these, are each as the relative velocity of the floatboards, the momentum must be as the square of the relative velocity, that is, $M \doteqdot R^2$, M being the momentum, and R the relative velocity. But we have seen, in some of the preceding paragraphs, that the water acts on more than one floatboard at a time. Now, the number of floatboards acted upon in a given time will be as the velocity of the wheel, or inversely as the relative velocity; for if you increase the relative velocity, the velocity of the water remaining the same, you must diminish the velocity of the wheel. Consequently, we shall have $M \doteqdot \frac{R^2}{R}$ or $M \doteqdot R$; that is, the momentum of the water acting upon the wheel is directly as the relative velocity.

327. Let V be now the velocity of the stream, and F the force with which it would strike the floatboard at rest, and v the velocity of the wheel. Then the relative velocity will be $V - v$; and since the velocity of the water will be to its momentum, or the force with which it would strike the floatboard at rest, as the relative velocity is to the real force which the water exerts against the moving floatboards, we shall have $V : V - v = F : F \times \frac{\overline{V-v}}{V} = \frac{F}{V} \times \overline{V-v}$. But the effect of the wheel is measured by the product of the momentum of the water and the velocity of the wheel, consequently the effect of the undershot-wheel will be $v \times \frac{F}{V} \times \overline{V-v} = \frac{F}{V} \times \overline{V v - v^2}$. Now, this effect is to be a maximum, and therefore its fluxion must be equal to 0, that is, v being the variable quantity, $V\dot{v} - 2v\dot{v} = 0$, or $2v\dot{v} = V\dot{v}$. Dividing by $\dot{v}$, we have $2v = V$, and $v = \frac{V}{2}$, that is, the velocity of the wheel will be *one-half* the velocity of the fluid when the effect is a maximum.

328. This result, which was first obtained by the Chevalier de Borda, has been amply confirmed by the experiments of Mr Smeaton. "The velocity of the stream," says he, "varies at the maximum between one-third and one-half that of the water; but in all the cases in which most work is performed in proportion to the water expended, and which approach the nearest to the circumstances of great works, when properly executed, the maximum lies much nearer *one-half* than *one-third*, one-half seeming to be the true maximum, if nothing were lost by the resistance of the air, the scattering of the water carried up by the wheel," &c.

329. A result, nearly similar to this, was deduced from the experiments of Bossut. He employed a wheel whose diameter was three feet. The number of floatboards was at one time 48, and at another 24, their width being five inches, and their depth six. The experiments with the wheel, when it had 48 floatboards, were made in an inclined canal, supplied from a reservoir by an orifice two inches deep, the velocity being 300 feet in 27 seconds. The experiments with the wheel, when it had 24 floatboards, were made in a canal, contained between two vertical walls, 12 or 13 feet distant. The depth of the water was about seven or eight inches, and its mean velocity about 2740 inches in 40 seconds. The floatboards of the wheel were immersed about four inches in the stream.

Time in which the load is raised.	Number of pounds raised.	Number of turns made by the wheel.	Number of pounds raised.	Number of turns made by the wheel.
Seconds.	48 Floatboards.		24 Floatboards.	
40	$30\frac{1}{2}$	$22\frac{12}{48}$	30	$17\frac{22}{48}$
40	31	$22\frac{4}{48}$	35	$16\frac{25}{48}$
40	$31\frac{1}{2}$	$21\frac{42}{48}$	40	$15\frac{28}{48}$
40	32	$21\frac{32}{48}$	45	$14\frac{31}{48}$
40	$32\frac{1}{2}$	$21\frac{20}{48}$	50	$13\frac{34}{48}$
40	33	$21\frac{8}{48}$	55	$12\frac{37}{48}$
40	$33\frac{1}{2}$	$20\frac{44}{48}$	56	$12\frac{28}{48}$
40	34	$20\frac{32}{48}$	57	$12\frac{19}{48}$
40	$34\frac{1}{2}$	$20\frac{21}{48}$	58	$12\frac{10}{48}$
40	35	$19\frac{44}{48}$	59	$12\frac{1}{48}$
40	$35\frac{1}{2}$	$19\frac{15}{48}$	60	$11\frac{40}{48}$
40	36	$18\frac{28}{48}$	61	$11\frac{30}{48}$
40			62	$11\frac{19}{48}$
			63	$11\frac{7}{48}$
			64	$10\frac{41}{48}$
			65	$10\frac{25}{48}$
			66	$10\frac{5}{48}$

330. As the effect of the machine is measured by the product of the load raised, and the time employed, it will appear, by multiplying the second and third columns, that the effect was a maximum when the load was $34\frac{1}{2}$ pounds, the wheel performing $20\frac{21}{48}$ revolutions in 40 seconds. By comparing the velocity of the centre of impression computed from the diameter of the wheel, and the number of turns which it makes in 40 seconds, with the velocity of the current, it will be found, that the velocity of the wheel, when its effect is the greatest possible, is nearly two-fifths that of the stream. From the two last columns of the table, where the effect is a maximum when the load is 60 pounds, the same conclusion may be deduced.

Method of constructing a millwright's table.

331. The proper velocity of the wheel being thus established, we shall proceed to point out the method of constructing a millwright's table for undershot-wheels, taking it for granted that the velocity of the wheel should be one-half the velocity of the stream, and that water moves with the same velocity as falling bodies.

Fig. 87.

1. Find the perpendicular height of the fall of water above the bottom of the mill-course, and having diminished this number by one-half the depth of the water at K, call that the height of the fall.

2. Since bodies acquire a velocity of 32.174 feet, by falling through the height of 16.087 feet; and as the velocities of falling bodies are as the square roots of the heights through which they fall, the square root of 16.087 will be to the square root of the height of the fall as 32.174 to a fourth number, which will be the velocity of the water. Therefore the velocity of the water may be always found by multiplying 32.174 by the square root of the height of the fall, and dividing that product by the square root of 16.087. Or it may be found more easily by multiplying the height of the fall by the constant quantity $64.348 = 2 \times 32.174$, and extracting the square root of the product. This root, abstracting from the effects of friction, will be the velocity of the water required.

3. Take *one-half* the velocity of the water, and it will be the velocity which must be given to the floatboards, or the number of feet they must move through in a second, in order to produce a maximum effect.

4. Divide the circumference of the wheel by the velocity of its floatboards per second, and the quotient will be the number of seconds in which the wheel revolves.

5. Divide 60 by the number last found, and the quotient will be the number of turns made by the wheel in a minute.

—Or the number of revolutions performed by the wheel in a minute may be found, by multiplying the velocity of the floatboards by 60, and dividing the product by the circumference of the wheel.

6. Divide 90, the number of revolutions which a millstone, five feet diameter, should make in a minute, by the number of revolutions made by the wheel in a minute; and the quotient will be the number of turns which the millstone ought to make for one revolution of the wheel.

7. Then, as the number of revolutions of the wheel in a minute is to the number of revolutions of the millstone in a minute, so must the number of staves in the trundle be to the number of teeth in the wheel, in the nearest whole numbers that can be found.

8. Multiply the number of revolutions performed by the wheel in a minute, by the number of revolutions made by the millstone for one of the wheel, and the product will be the number of revolutions made by the millstone in a minute.

332. By these rules, the following table has been computed for a water-wheel fifteen feet in diameter, which is a good medium size, the millstone being seven feet in diameter, and revolving 90 times in a minute.

TABLE I. *A New Mill-Wright's Table, in which the Velocity of the Wheel is one-half the Velocity of the Stream, the effects of Friction not being considered.*

Height of the fall of water.	Velocity of the water per second, friction not being considered.	Velocity of the wheel per second, being one-half that of the water.	Revolutions of the wheel per minute, its diameter being 15 feet.	Revolutions of the millstone for one of the wheel.	Teeth in the wheel and staves in the trundle.		Revolutions of the millstone per minute by these staves and teeth.
Feet.	Feet. 100 parts of a foot.	Feet. 100 parts of a foot.	Revol. 100 parts of a revol.	Revol. 100 parts of a revol.	Teeth.	Staves.	Revol. 100 parts of a revol.
1	8.02	4.01	5.10	17.65	106	6	90.01
2	11.34	5.67	7.22	12.47	87	7	90.03
3	13.89	6.95	8.85	10.17	81	8	90.00
4	16.04	8.02	10.20	8.82	79	9	89.96
5	17.94	8.97	11.43	7.87	71	9	89.95
6	19.65	9.82	12.50	7.20	65	9	90.00
7	21.22	10.61	13.51	6.66	60	9	89.98
8	22.69	11.34	14.45	6.23	56	9	90.02
9	24.06	12.03	15.31	5.88	53	9	90.02
10	25.37	12.69	16.17	5.57	56	10	90.06
11	26.60	13.30	16.95	5.31	53	10	90.00
12	27.79	13.90	17.70	5.08	51	10	89.91
13	28.92	14.46	18.41	4.89	49	10	90.02
14	30.01	15.01	19.11	4.71	47	10	90.00
15	31.07	15.53	19.80	4.55	48	11	90.09
16	32.09	16.04	20.40	4.45	44	10	89.96
17	33.07	16.54	21.05	4.28	47	11	90.09
18	34.03	17.02	21.66	4.16	50	12	90.10
19	34.97	17.48	22.26	4.04	44	11	89.93
20	35.97	17.99	22.86	3.94	48	12	90.07
1	2	3	4	5	6		7

333. The preceding table (*Appendix to Ferguson's Lectures*, vol. ii. p. 174) supposes, according to theory, that the velocity of the wheel, at the maximum effect, is one-half that of the stream, which is nearly the case in practice, when the quantities of water discharged by the stream are considerable. "When we consider, however," observes the editor of the work now quoted, "that after every precaution has been observed, a small quantity of water will escape between the mill-course and the extremities of the floatboards, and that the effect is diminished by the resistance of the air and the dispersion of water carried up by the wheel, the propriety of making the wheel move with three-sevenths the velocity of the water will appear. The Chevalier de Borda supposes it never to exceed three-eighths; and Mr Smeaton and the Abbé Bossut found two-fifths to be the proper medium.[1] With three-sevenths, therefore, as the best medium, which differs only $\frac{1}{35}$th from $\frac{2}{5}$ths, the numbers in the following table have been computed. In Table I. the water was supposed to move with the same velocity as falling bodies, but owing to its friction on the mill-course, &c. this is not exactly the case. We have therefore deduced the velocity of the water in column second from the following formula, $V = \sqrt{\frac{172}{3} \times Rb - \frac{Hh}{2}}$, Fig. 85

in which V is the velocity of the water, Rb the absolute height of the fall, and Hh the depth of the water at the bottom of the course. The formula is founded on the experiments of Bossut, from which it appears, that if a canal be inclined one-tenth part of its length, this additional declivity will restore that velocity to the water which was destroyed by friction."

TABLE II. *A New Mill-Wright's Table, in which the Velocity of the Wheel is three-sevenths of the Velocity of the Water, and the effects of Friction on the Velocity of the stream reduced to computation.*

Height of the fall of water.	Velocity of the water per second, friction being considered.	Velocity of the wheel per second, being 3-7ths that of the water.	Revolutions of the wheel per minute, its diameter being 15 feet.	Revolutions of mill-stone for one of the wheel.	Teeth in the wheel and staves in the trundle.		Revolutions of the millstone per minute by these staves and teeth.
Feet.	Feet. 100 parts of a foot.	Feet. 100 parts of a foot.	Revol. 100 parts of a revol.	Revol. 100 parts of a revol.	Teeth.	Staves.	Revol. 100 parts of a revol.
1	7.62	3.27	4.16	21.63	130	6	89.98
2	10.77	4.62	5.88	15.31	92	6	90.02
3	13.20	5.66	7.20	22.50	100	8	90.00
4	15.24	5.53	8.32	10.81	97	9	89.94
5	17.04	7.30	9.28	9.70	97	10	90.02
6	18.67	8.00	10.19	8.83	97	11	89.98
7	20.15	8.64	10.99	8.19	90	11	90.01
8	21.56	9.24	11.76	7.65	84	11	89.96
9	22.86	9.80	12.47	7.22	72	10	90.03
10	24.10	10.33	13.15	6.84	82	12	89.95
11	25.27	10.83	13.79	6.53	85	13	90.05
12	26.40	11.31	14.40	6.25	72	12	90.00
13	27.47	11.77	14.99	6.00	72	12	89.94
14	28.51	12.22	15.56	5.78	75	13	90.04
15	29.52	12.65	16.13	5.58	67	12	90.01
16	30.48	13.06	16.63	5.41	65	12	89.97
17	31.42	13.46	17.14	5.25	63	12	89.99
18	32.33	13.86	16.65	5.10	61	12	90.01
19	33.22	14.24	18.13	4.96	64	13	89.92
20	34.17	14.64	18.64	4.83	58	12	89.84
1	2	3	4	5	6		7

[1] The great hydraulic machine at Marly was found to produce a maximum effect, when its velocity was two-fifths of that of the stream.

O Vater- eels.

334. In order that the wheel may move with a velocity duly adjusted to that of the current, we would not advise the mechanic to trust to the second column of Table II. for the true velocity of the stream, or to any theoretical results, even when deduced from formulæ founded on experiments. Bossut, with great justice, remarks, that "it would not be exact in practice to compute the velocity of a current from its declivity. This velocity ought to be determined by immediate experiment in every particular case." Let the velocity of the water, therefore, where it strikes the wheel, be determined by the method in the following paragraph. With this velocity, as an argument, enter column second of either of these tables, according as the velocity of the wheel is to be one-half or three-sevenths that of the stream, and take out the other numbers from the table.

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335. Various methods have been proposed by different philosophers for measuring the velocity of running water; the method, by floating bodies, which Mariotte[1] employed, the bent tube of Pitot[2], the regulator of Guglielmini[3], the quadrant[4], the little wheel[5], and the method proposed by the Abbé Mann[6], have each their advantages and disadvantages. The little wheel was employed in the experiments of Bossut. It is the most convenient mode of determining the superficial velocity of the water; and, when constructed in the following manner, will be more accurate, it is hoped, than any instrument that has hitherto been used. The small wheel WW should be formed of the lightest materials. It should be about ten or twelve inches in diameter, and furnished with fourteen or sixteen floatboards. This wheel moves upon a delicate screw a B, passing through its axle B b; and when impelled by the

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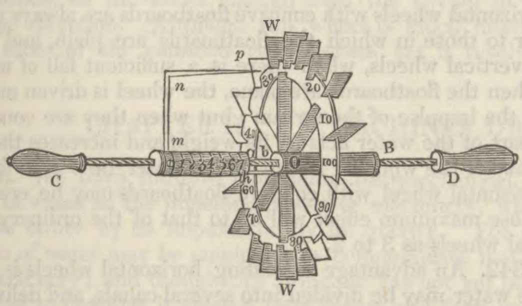
Fig. 83.



stream it will gradually approach towards D, each revolution of the wheel corresponding with a thread of the screw. The number of revolutions performed in a given time are determined upon the scale $m\ a$, by means of the index O h fixed at O, and moveable with the wheel, each division of the scale being equal to the breadth of a thread of the screw, and the extremity h of the index O h coinciding with the beginning of the scale, when the shoulder b of the wheel is screwed close to a. The parts of a revolution are indicated by the bent index $m\ n$, pointing to the periphery of the wheel, which is divided into 100 parts. When this instrument is to be used, take it by the handles CD, or when great accuracy is required, make it rest on the handles CD; and screw the shoulder b of the wheel close to a, so that the indices may both point to o the commencement of the scales. Then, by means of a stop-watch or pendulum, find how many revolutions of the wheel are performed in a given time. Multiply the mean circumference of the wheel (or the circumference deduced from the mean radius, which is equal to the distance of the centre of impulsion or impression from the axis b B) by the number of revolutions, and the product will be the number of feet through which the water moves in the given time. On account of the friction of the screw, the resistance of the air, and the weight of the wheel, its centre of impression will revolve with a little less velocity than that of the stream; but the diminution of velocity, arising from these causes, may be estimated with sufficient precision for all the purposes of the practical mechanic. (*Appendix to Ferguson's Lectures*, vol. ii. p. 177.)

On Water-Wheels.

Results of Smeaton's experiments.

336. It appears, from a comparison of the numerous and accurate experiments of Mr Smeaton, that, in undershot-wheels, the power employed to turn the wheel is to the effect produced as 3 to 1; and that the load which the wheel will carry at its maximum, is to the load which will totally stop it, as 3 to 4. The same experiments inform us, that the impulse of the water on the wheel, in the case of a maximum, is more than double of what is assigned by theory, that is, instead of four-sevenths of the column, it is nearly equal to the whole column. In order to account for this, Mr Smeaton observes, that the wheel was not, in this case, placed in an open river, where the natural current, after it had communicated its impulse to the float, has room on all sides to escape, as the theory supposes; but in a conduit or race, to which the float being adapted, the water could not otherwise escape than by moving along with the wheel. He likewise remarks, that when a wheel works in this manner, the water, as soon as it meets the float, receives a sudden check, and rises up against it like a wave against a fixed object; insomuch, that when the sheet of water is not a quarter of an inch thick before it meets the float, yet this sheet will act upon the whole surface of a float, whose height is three inches. Were the float, therefore, no higher than the thickness of the sheet of water, as the theory supposes, a great part of the force would be lost by the water dashing over it. In order to try what would be the effect of diminishing the number of floatboards, Mr Smeaton reduced the floatboards, which were originally 24 to 12. This change produced a diminution of the effect, as a greater quantity of water escaped between the floats and the floor. But when a circular sweep was adapted to the floor, and made of such a length that one float entered the curve before the preceding one quitted it, the effect came so near to the former, as to afford no hopes of increasing it by augmenting the number of floats beyond 24 in this particular wheel. Mr Smeaton likewise deduced, from his experiments, the following maxims.

1. That the virtual or effective head being the same, the effect will be nearly as the quantity of water expended.
2. That the expense of water being the same, the effect will be nearly as the height of the virtual or effective head.
3. That the quantity of water expended being the same, the effect is nearly as the square of the velocity.
4. The aperture being the same, the effect will be nearly as the cube of the velocity of the water.

Undershot-wheels with floatboards inclined to the plane of the wheel.

337. We have hitherto supposed the floatboards, though inclined to the radius, to be perpendicular to the plane of the wheel. Undershot-wheels, however, have sometimes been constructed with floatboards inclined to the plane of the wheel. A wheel of this kind is represented in fig 89. where AB is the wheel, and CDEFGH the oblique floatboards. The horizontal current MN is delivered on the floatboards, so as to strike them perpendicularly. On account of the size of the floatboards, every filament of the water contributes to turn the wheel; and therefore its effect will be greater than in undershot wheels of the common form. Albert Euler imagines that the effect will be twice as great, and observes, that in order to produce such an

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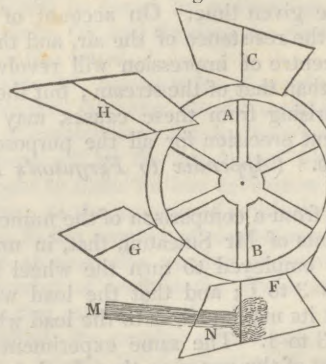
[1] *Traité du Mouvement des Eaux.*
[2] *Mém. de l'Acad. Paris*, 1732.
[3] *Aquarum Fluentium Mensura*, lib. iv.
[4] Bossut, *Traité d'Hydrodynamique*, art. 654.
[5] Bossut, *Traité d'Hydrodynamique*, art. 655.
[6] *Philosophical Transactions*, vol. lxix.

On Water-Wheels.

Fig. 89.



effect, the velocity of the centre of impression should be to the velocity of the water, as radius is to triple the sine of the angle by which the floatboards are inclined to the plane of the wheel. If this inclination, therefore, be 60°, the velocity of the wheel at the centre of impression ought to be to the velocity of the impelling fluid as 1 to $\frac{3\sqrt{3}}{2}$, that is, as 5 to 13 nearly, because Sin. $60° = \frac{\sqrt{3}}{2}$. When the inclination is 30°, the ratio of the velocities will be found to be as 2 to 3.

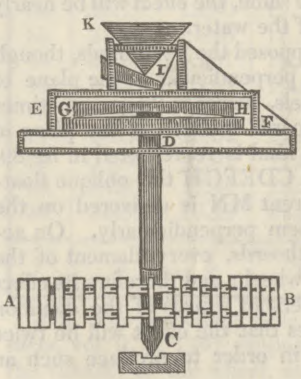
And also to the radius.

338. In wheels of this kind, the floats may also be advantageously inclined to the radius. In this case, the stream, which still strikes them perpendicularly, is inclined to the horizon. If the angle formed by the common section of the wheel and floatboards with the radius of the wheel, be $= m$; and if the angle by which the floatboards are inclined to the plane of the wheel be $= n$, then the angle which the floatboards should form with the direction in which the wheel moves, will be $= \overline{\text{Cos.}\, m \times \text{Sin.}\, n}$. In order, therefore, that the stream may strike the floatboards with a perpendicular impulse, its inclination to the horizon must be $= m$, and its inclination to the plane of the wheel $= 90° - n$. The less that the velocity of the water is, the greater should be the angle m; for there is, in this case, no danger that the celerity of the wheel be too great. The area of the floatboards ought to be much greater than the section of the current; and the interval between two adjacent floatboards should be so great, that before the one completely withdraws itself from the action of the water, the other should begin to receive its impulse.

On horizontal water-wheels.

339. Horizontal water-wheels have been much used on the Continent, and are strongly recommended to our notice by the simplicity of their construction. In fig. 90, AB is the large water-wheel which moves horizontally upon its arbor CD. This arbor passes through the immoveable millstone EF at D, and being fixed to the upper one GH, carries it once round for every revolution of the great wheel. The mill-course is constructed in the same manner for horizontal as for vertical wheels, with this difference only, that the part $m\,B\,n\,C$, fig. 85 of which KL in fig. 86 is a section, instead of being rectilineal like mn, must be circular like $m\,P$, and concentric with the rim of the wheel, sufficient room being left between it and the tips of the floatboards for the play of the wheel. In this construction, where the water moves

Fig. 90.



in a horizontal direction before it strikes the wheel, the floatboards should be inclined about 25° to the plane of the wheel, and the same number of degrees to the radius, so that the lowest and outermost sides of the floatboards may be farthest up the stream.

340. Instead of making the canal horizontal before it delivers the water on the floatboards, they are frequently inclined in such a manner as to receive the impulse perpendicularly, and in the direction of the declivity of the mill-course. When this construction is adopted, the maximum effect will be produced when the velocity of the floatboards is not less than $\frac{5.67\sqrt{H}}{2 \text{ Sin. } A}$, where H represents the height of the fall, and A the angle which the direction of the fall makes with a vertical line. But as the quantity $\frac{5.67\sqrt{H}}{2 \text{ Sin. } A}$ evidently increases as the sine of A decreases, it follows, that without lessening the effect of these wheels, we may diminish the angle A, and thus augment considerably the velocity of the floatboards, according to the nature of the machinery employed; whereas, in vertical wheels, there is only one determinate velocity which produces a maximum effect.

341. In the southern provinces of France, where horizontal wheels are generally employed, the floatboards are made of a curvilineal form, so as to be concave towards the stream. The Chevalier de Borda observes, that in theory a double effect is produced when the floatboards are concave; but that effect is diminished in practice, from the difficulty of making the fluid enter and leave the curve in a proper direction. Notwithstanding this difficulty, however, and other defects which might be pointed out, horizontal wheels with concave floatboards are always superior to those in which the floatboards are plain, and even to vertical wheels, when there is a sufficient fall of water. When the floatboards are plane, the wheel is driven merely by the impulse of the stream; but when they are concave, a part of the water acts by its weight and increases the velocity of the wheel. If the fall of water be 5 or 6 feet, a horizontal wheel with concave floatboards may be erected, whose maximum effect will be to that of the ordinary vertical wheels as 3 to 2.

342. An advantage attending horizontal wheels is, that the water may be divided into several canals, and delivered upon several floatboards at the same time. Each stream will heap up on its corresponding floatboard, and produce a greater effect than if the force of the water had been concentrated on a single floatboard. Horizontal wheels may be employed with greatest advantage when a small quantity of water falls through a considerable height.

343. It has been disputed among mechanical philosophers, whether overshot or undershot wheels produce the greatest effect. M. Belidor maintained that the former were inferior to the latter, while a contrary opinion was entertained by Desaguliers. It appears, however, from Mr Smeaton's experiments, that in overshot-wheels the power is to the effect nearly as 3 to 2 or as 5 to 4 in general, whereas in undershot-wheels it is only as 3 to 1. The effect of overshot-wheels, therefore, is nearly double that of undershot-wheels, other circumstances being the same. In comparing the relative effects of water-wheels, the Chevalier de Borda remarks that overshot wheels will raise through the height of the fall, a quantity of water equal to that by which they are driven; that undershot vertical wheels will produce only three-eighths of this effect; that horizontal wheels will produce a little less than one-half of it when the floatboards are plain, and a little more than one-half of it when the floatboards have a curvilineal form.

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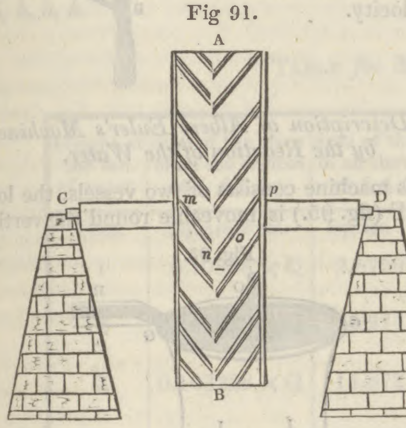
Besant's Undershot-Wheel.

344. The water-wheel invented by Mr Besant of Brompton is constructed in the form of a hollow drum, so as to resist the admission of the water. The floatboards are fixed obliquely in pairs on the periphery of the wheel, so that each pair may form an acute angle open at its vertex, while one of the floatboards extends beyond the vertex of the angle. A section of the water-wheel is represented in fig. 91, where AB is the wheel, CD its axis, and *mn op* the

Fig 91.



position of the floatboards. The motion of common undershot-wheels is greatly retarded by the resistance which the tail-water and the atmosphere oppose to the ascending floatboards; but in Besant's wheel this resistance is greatly diminished, as the floats emerge from the stream in an oblique direction. Although this wheel is much heavier than those of the common construction, yet it revolves more easily upon its axis, as the stream has a tendency to make it float.

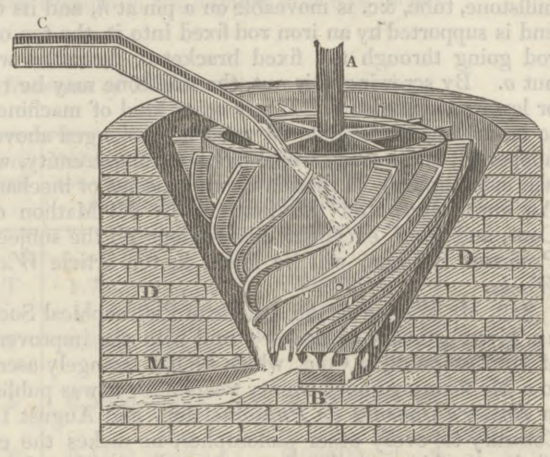
Machines driven by the Reaction of Water.

Conical Horizontal Wheel with Spiral Floatboards.

Description of a conical horizontal wheel with spiral floatboards.

345. In Guyenne and Languedoc, in the south of France, a kind of conical horizontal wheel is sometimes employed for turning machinery. It is constructed in the form of an inverted cone AB, fig. 92, with spiral floatboards winding

Fig. 92.



round its surface. The wheel moves on a vertical axis AB, in the building DD, and is driven chiefly by the impulse of the water conveyed by the canal C to the oblique floatboards, the direction of the current being perpendicular to the floatboards at the place of impact. When the impulsive force of the water is annihilated, it descends along the spirals, and continues to act by its weight till it reaches the bottom, when it is carried off by the canal M.

CHAPTER II. ON MACHINES DRIVEN BY THE REACTION OF WATER.

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346. We have hitherto considered the mechanical effects of water as the impelling power of machinery, when it acts either by its impulse or by its gravity. The reaction of water may be employed to communicate motion to machinery; and though this principle has not yet been adopted in practice, it appears from theory and from some detached experiments on a small scale, that a given quantity of water, falling through a given height, will produce greater effects by its reaction than by its impulse or its weight.

Sect. I. *On Dr Barker's Mill.*

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347. This machine, which is sometimes called Parent's mill, is represented in fig. 93, where MN is the canal that conveys the water into the upright tube TT, which communicates with the horizontal arm AB. The water will therefore descend through the upright tube into this arm, and will exert upon the inside of it a pressure proportioned to the height of the fall. But if two orifices A and B be perforated at the extremities of the arm, and on contrary sides, the pressure upon these orifices will be removed by the efflux of the water, and the unbalanced pressure upon the opposite sides of the arm will make the tube and the horizontal arm revolve upon the spindle D as an axis. This will be more easily understood, if we suppose the orifices to be shut up, and consider the pressure upon a circular inch of the arm opposite to the orifice, the orifice being of the same size. The pressure upon this circular inch will be equal to a cylinder of water whose base is one inch in diameter, and whose altitude is the height of the fall; and the same force is exerted upon the

Fig. 93.

shut-up orifice. These two pressures, therefore, being equal and opposite, the arm A will remain at rest. But as soon as you open the orifice, the water will issue with a velocity due to the height of the fall; the pressure upon the orifice will of consequence be removed; and as the pressure upon the circular inch opposite to the orifice still con-

Machines driven by the Reaction of Water.

tinues, the equilibrium will be destroyed, the arm will move in a retrograde direction.

348. The upright spindle D, on which the arm revolves, is fixed in the bottom of the arm, and screwed to it below by a nut. It is fixed to the upright tube by two cross bars, so as to move along with it. If a corn-mill is to be driven, the top of the spindle is fixed into the upper millstone *m*. The lower quiescent millstone *n* rests upon the floor K, in which is a hole, to let the meal pass into a trough below. The bridgetree GF, which supports the millstone, tube, &c. is moveable on a pin at *h*, and its other end is supported by an iron rod fixed into it, the top of the rod going through the fixed bracket 0, furnished with a nut *o*. By screwing this nut, the millstone may be raised or lowered at pleasure. If any other kind of machinery is to be driven, the spindle D must be prolonged above the hopper H, and a small wheel fixed to its extremity, which will communicate its motion to any species of mechanism. An improvement on this machine by M. Mathon de la Cour, and some excellent observations on the subject by Professor Robison, will be found in the article *Water-Works*.

349. Mr Waring of the American Philosophical Society, has given a theory of Barker's mill with the improvement of M. Mathon de la Cour, which he has strangely ascribed to a Mr Rumsey about twenty years after it was published in *Rozier's Journal de Physique*, Jan. and August 1775. Contrary to every other philosopher, he makes the effect of the machine equal only to that of a good undershot-wheel, moved with the same quantity of water, falling through the same height. The following rules, however, deduced from his calculus, may be of use to those who may wish to make experiments on the effect of this interesting machine.

Practical rules.

1. Make the arm of the rotatory tube or arm C, from the centre of motion to the centre of the aperture, of any convenient length, not less than one-third (one-ninth according to Mr Gregory,[1] who has corrected some of Waring's numbers) of the perpendicular height of the water's surface above their centres.

2. Multiply the length of the arm in feet by .614, and take the square root of the product for the proper time of a revolution in seconds, and adapt the other parts of the machinery to this velocity; or, if the time of a revolution be given, multiply the square of this time by 1.63 for the proportional length of the arm.

3. Multiply together the breadth, depth, and velocity per second, of the race, and divide the last product by 18.47 (times 14.27 according to Mr Gregory) the square root of the height, for the area of either aperture.

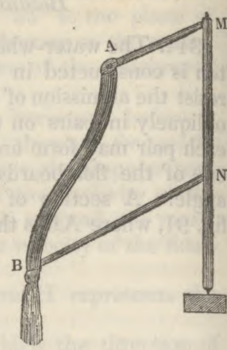
4. Multiply the area of either aperture by the height of the fall of water, and the product by $41\frac{5}{8}$ pounds (55.775 according to Mr Gregory), for the moving force estimated at the centres of the apertures in pounds avoirdupois.

5. The power and velocity at the aperture may be easily reduced to any part of the machinery by the simplest mechanical rules.

Form given to Barker's mill by Professor Segner.

350. Long after the preceding machine had been described in several of our English treatises on machines, Professor Segner published in his hydraulics, as an invention of his own, the account of a machine, differing from this only in form. MN was the axis of the machine, corresponding with DX in Barker's mill, and a number of tubes AB (fig. 94.) were also so arranged round this axis, that their higher extremities A formed a circular superficies, into which the water flowed from a reservoir. When the machine has this form, it has been shewn by Albert Euler that the maximum effect is produced when the velocity is infinite, and that the effect is equal to the power. As a considerable portion of the power, however, must be consumed in communicating to the fluid the circular motion of the tubes; and as the portion thus lost must increase with the velocity of the tube, the effect will in reality sustain a diminution from an increase of velocity.

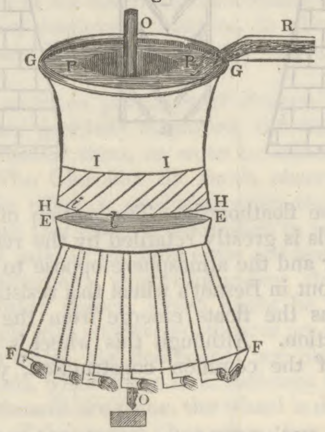
Fig. 94.



Sect. II. *Description of Albert Euler's Machine driven by the Reaction of the Water.*

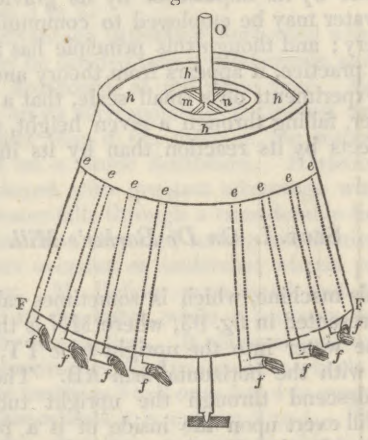
351. This machine consists of two vessels, the lowest of which EEFF (fig. 95.) is moveable round the vertical axis

Fig. 95.



OO, while the higher vessel remains immoveable. The form of the lowest vessel, which is represented by itself in fig. 96, is similar to that of a truncated bell, which is fastened by the cross beams *m*, *n* to the axis O, so as to move along with it. The annular cavity *hhhh* terminates at *ee* in several tubes *ef*, *ef*, *ef*, diverging from the axis. Through the lower extremities of these tubes, which are bent into a right angle, the water flowing from the cavity *hhhh* issues with a velocity due to the altitude of its surface in *h*, *h*, and produces by its reaction a rotatory and retrograde motion

Fig. 96.



[1] Gregory's *Mechanics*, vol. ii. p. 111.

round the axis OO. The cavity of the ring h, h, receives the water from the superior vessel GGHH, similar to the inferior vessel in fig. 95, but not connected with the axis OO. This vessel has also an annular cavity PP, into which the water is conveyed from a reservoir by the canal R. Around the lower part HH of the cavity, this vessel is divided into several apertures Ii, placed obliquely that the water may descend with proper obliquity into the inferior vessel. The width of the higher vessel at HH ought to be equal to the width of the lower vessel at EE, that the water which issues from the former may exactly fill the annular cavity h, h, h, h.

When the machine is constructed in this way, its maximum effect will be equal to the power, provided all its parts be proportioned and adjusted according to the results in the following table, computed from the formulæ of Albert Euler. In the table, Machines driven by the Reaction of Water.

Q = the quantity of water, or number of cubic feet of water furnished in a second.
T = the time, or number of seconds in which the lower vessel revolves.
B = the breadth of the annular orifice in inches.

TABLE *for Mills driven by the Reaction of Water.*

Table for mills driven by the reaction of water.

Height of the fall of water.	Sum of the areas of all the orifices at f, f, f, &c.	Sum of the areas of all the orifices at f, f, f, &c.	Mean radius of the annular orifice HH.	Difference between the altitude of the two vessels.	Tangent of the inclination of the tubes to the horizon.
Feet.	Square Feet.	Square Inches.	Feet.	Inches.	
1	0.17888 × Q	2.5759 × Q	0.8897 × T	$1.7695 \frac{QQ}{TTBB}$	$0.38400 \frac{Q}{TB}$
2	0.12649 × Q	18.214 × Q	1.2582 × T	$0.8847 \frac{QQ}{TTBB}$	$0.19200 \frac{Q}{TB}$
3	0.103228 × Q	14.872 × Q	1.5410 × T	$0.5898 \frac{QQ}{TTBB}$	$0.12800 \frac{Q}{TB}$
4	0.08944 × Q	12.880 × Q	1.7794 × T	$0.4424 \frac{QQ}{TTBB}$	$0.09600 \frac{Q}{TB}$
5	0.08000 × Q	11.520 × Q	1.9894 × T	$0.3539 \frac{QQ}{TTBB}$	$0.07680 \frac{Q}{TB}$
6	0.07303 × Q	10.516 × Q	2.1793 × T	$0.2949 \frac{QQ}{TTBB}$	$0.06400 \frac{Q}{TB}$
7	0.06761 × Q	9.736 × Q	2.3540 × T	$0.2528 \frac{QQ}{TTBB}$	$0.05486 \frac{Q}{TB}$
8	0 06325 × Q	9.107 × Q	2.5165 × T	$0.2212 \frac{QQ}{TTBB}$	$0.04800 \frac{Q}{TB}$
9	0.05963 × Q	8.586 × Q	2.6691 × T	$0.1966 \frac{QQ}{TTBB}$	$0.04267 \frac{Q}{TB}$
10	0.05657 × Q	8.146 × Q	2.8135 × T	$0.1769 \frac{QQ}{TTBB}$	$0.03840 \frac{Q}{TB}$
11	0.05394 × Q	7.767 × Q	2.9508 × T	$0.1609 \frac{QQ}{TTBB}$	$0.03491 \frac{Q}{TB}$
12	0.05104 × Q	7.436 × Q	3.0820 × T	$0.1475 \frac{QQ}{TTBB}$	$0.03200 \frac{Q}{TB}$
13	0.04961 × Q	7.144 × Q	3.2078 × T	$0.1361 \frac{QQ}{TTBB}$	$0.02954 \frac{Q}{TB}$
14	0.04781 × Q	6.885 × Q	3.3290 × T	$0.1264 \frac{QQ}{TTBB}$	$0.02743 \frac{Q}{TB}$
15	0.04619 × Q	6.651 × Q	3.4458 × T	$0.1179 \frac{QQ}{TTBB}$	$0.02560 \frac{Q}{TB}$
16	0.04472 × Q	6.440 × Q	3.5588 × T	$0.1106 \frac{QQ}{TTBB}$	$0.02400 \frac{Q}{TB}$
17	0.04339 × Q	6.248 × Q	3.6683 × T	$0.1041 \frac{QQ}{TTBB}$	$0.02259 \frac{Q}{TB}$
18	0.04216 × Q	6.072 × Q	3.7747 × T	$0.0983 \frac{QQ}{TTBB}$	$0.02133 \frac{Q}{TB}$
1	2	3	4	5	6

The determinations in the preceding table are exhibited in a general manner, that the machine may be accommodated to local circumstances. The time of a revolution T, for instance, is left undetermined, because upon this time depends the magnitude of the machine; and T may be assumed of such a value that the dimensions of the machine may be suitable to the given place, or to the nature of the work to be performed.

352. In order to shew the application of the preceding table, let it be required to construct the machine when the height of the fall is five feet, and when the reservoir furnishes one cubic foot of water in a second. In this case Example.

On Machines for raising Water.

$Q = 1$, and therefore, by column 3, the sum of the areas of the orifices will be 11.52 square inches. Consequently, if there are twelve orifices, the area of each orifice will be $\frac{11.52}{12} = 0.96$ of a square inch. Suppose the time of a revolution to be $= 1$ second, or $T = 1$, then the 4th column will give the mean radius of the annular orifice $= 1.9894$ feet, or nearly two feet. Let the breadth of the annular orifice, or $B = \frac{1}{2}$ an inch, then the difference between the altitude of each vessel will be $0.3539 \times \frac{QQ}{TTBB} = 0.3539 \times \frac{1 \times 1}{\frac{1}{2} \times \frac{1}{2} \times 1 \times 1} = 0.3539 \times \frac{1}{\frac{1}{4}} = 0.3539 \times 4 =$ 1.4156 inches. Now, as the sum of the heights of the vessels must be always equal to the height of the fall, half that sum will in the present case be two feet six inches; and since half the difference of their altitudes is 7-10ths of an inch, the altitude of the superior vessel will be two feet six inches and seven-tenths, and that of the inferior vessel two feet five inches and three-tenths. It appears from the last column of the table, that the tangent of the inclination of the tubes is 0.1536, which corresponds with an angle of 8° 44′.

353. The theory of this machine has also been discussed by Leonhard Euler, in the *Mém. de l'Acad. Berlin*, vol. vi. p. 311; and its application to all kinds of work has been pointed out in a subsequent paper, entitled, *Application de la Machine Hydraulique de M. Segner à toutes forts d'ouvrage, et de ses avantages sur les autres Machines Hydrauliques dont on se sert ordinairement*, *Mém. Acad. Berlin*, tom. vii. 1752, p. 271. The results of Euler's analysis are not sufficiently practical for the use of the general reader. But it appears from his investigations, as well as from those of John Bernoulli and other philosophers, that the reaction of water is the most powerful way in which the force of that fluid can be employed.

354. It has often occurred to the writer of this article, that a very powerful hydraulic machine might be constructed by combining the impulse with the reaction of water. If the spout *a*, for example, instead of delivering the water into the higher vessel, were to throw it upon a number of curvilineal floatboards fixed on its circumference, and so formed as to convey the water easily into the spiral canals, we should have a machine something like the conical horizontal wheel in fig. 92, with spiral channels instead of spiral floatboards, and which would in some measure be moved both by the impulse, weight, and reaction of the water.

CHAPTER III. ON MACHINES FOR RAISING WATER.

Sect. I. *On Pumps.*

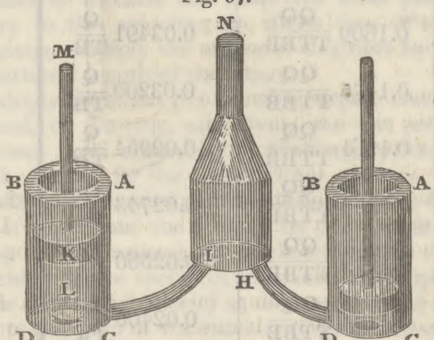
Reference to the article Pump.

355. The subject of pumps has been fully and ably discussed by Dr Robison under the article Pump, to which we must refer the reader for a complete view of the theory of the machine. In that article, however, a reference is made to the present for a description of the ancient pump of Ctesibius, and of those in common use to which it has given rise. To these subjects, therefore, we must now confine our attention.

Description of the original pump of Ctesibius.

356. The pump was invented by Ctesibius, a mathematician of Alexandria, who flourished under Ptolemy Psychon, about 120 years before Christ. In its original state, it is represented in fig. 97, where ABCD is a brass cylin-

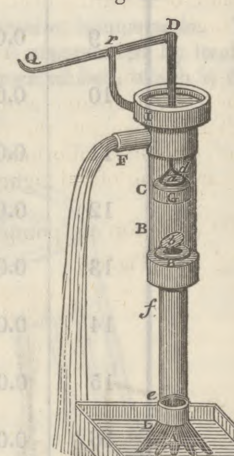
Fig. 97.



der with a valve L in its bottom. It is furnished with a piston MK made of green wood, so as not to swell in water, and adjusted to the bore of the cylinder by the interposition of a ring of leather. The tube CI connects the cylinder ABCD with another tube NH, the bottom of which is furnished with a valve I opening upwards. Now, when the extremity DC of the cylinder is immersed in water, and the piston MK elevated, the pressure of the water upon the valve L from below will be proportioned to the depth below the surface (41). The valve will therefore open, and admit the water into the cylinder. But when the piston is depressed, it will force the water into the tube CH, and through the valve I into the tube NH. As soon as the portion of water that was admitted into the cylinder ABCD, is thus impelled into the tube NH, the valve I will close. A second elevation of the piston will admit another quantity of fluid into the cylinder, and a second depression will force it into the tube NH; so that, by continuing the motion of the piston, the water may be elevated to any altitude in the tube. From this pump of Ctesibius are derived the three kinds of pumps now commonly used, the sucking, the forcing, and the lifting pump.

357. The common sucking pump is represented in fig. 98, where ICBL is the body of the pump immersed in the water at A. The moveable piston DG is composed of the piston rod D *d*, the piston or bucket G, and the valve *a*. The bucket H, which is fixed to the body of the pump, is likewise furnished with a valve *b*, which, like the valve *a*, should by its own weight lie close upon the hole in the bucket till the working of the engine commences. The valves are made of brass, and have their lower surface covered with leather, in order to fit the holes in the bucket more exactly. The moveable bucket G is covered with leather, so as to suit exactly the bore of the cylinder, and to prevent any air escaping between it and the pump. The piston DG may be elevated or depressed by the lever DQ, whose fulcrum is *r*, the extremity of the bent arm R *r*.

Fig. 98.



358. Let us now suppose the piston G to be depressed so that its inferior surface may rest upon the valve *b*. Then, if the piston G be raised to C, there would have been a vacuum between H and G if the valve *b* were immoveable. But as the valve *b* is moveable, and as the pressure of the air is removed from its superior surface, the air in the tube HL will, by its elasticity, force open the valve *b*, and expand itself through the whole cavity LC. This air, however, will be much rarer than that of the atmosphere; and since the equilibrium between the external

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air and that in the tube LH is destroyed by the rarefaction of the latter, the pressure of the atmosphere on the surface of the water in the vessel K will predominate, and raise the water to about *e* in the suction pipe HL, so that the air formerly included in the space LC will be condensed to the same state as that of the atmosphere. The elasticity of the air both above and below the valve *b* being now equal, that valve will fall by its own weight. Let the piston DG be now depressed to *b;* the air would evidently resist its descent, did not the valve *a* open and give a free exit to the air in the space CH, for it cannot escape through the inferior valve *b*. When the piston reaches *b*, the valve *a* will fall by its weight; and when the piston is again elevated, the incumbent air will press the valve *a* firmly upon its orifice. During the second ascent of the piston to C, the valve *b* will rise, the air between *e* H will rush into HC; and in consequence of its rarefaction, and inability to counteract the pressure of the atmosphere, the water will rise to *f*. In the same way it may be shewn, that at the next stroke of the piston the water will rise through the box H to B, and then the valve *b* which was raised by it will fall when the bucket G is at C. Upon depressing the bucket G again, the water cannot be driven through the valve *b*, which is pressed to its orifice by the water above it. At the next ascent of the piston a new quantity of water will rise through H, and follow the piston to C. When the piston again descends, the valve *a* will open; and as the water between C and H cannot be pushed through the valve *b*, it will rise through *a*, and have its surface at C when the piston G is at *b*; but when the piston rises, the valve *a* being shut by the water above it, this water will be raised up towards I, and issue at the pipe F. A new quantity of water will rush through H, and fill the space HC: consequently, the surface of the fluid will always remain at C, and every succeeding elevation of the piston from *b* to C will make the column of water CH run out at the pipe F.

Th uck- ng ump wil ot rai water hig than 33 t.

359. As the water rises in the pipe CL solely by the pressure of the atmosphere; and as a column of water, 33 feet high, is equal in weight to a column of air of the same base, reaching from the earth's surface to the top of the atmosphere, the water in the vessel K will not follow the piston G to a greater altitude than 33 feet; for when it reaches this height, the column of water completely balances, or is in equilibrium with, the atmosphere, and therefore cannot be raised higher by the pressure of the external air.

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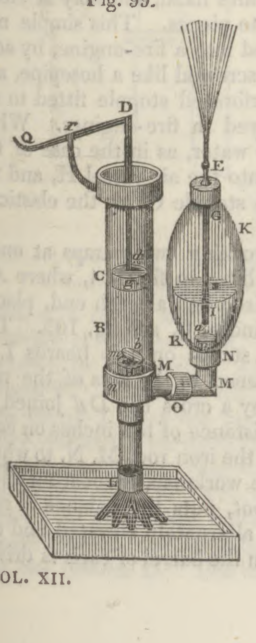
360. The forcing-pump is represented in fig. 99, where D *d* is the piston attached to a solid plunger *g*, adjusted to the bore of the pipe BC by the interposition of a ring of leather. The rectangular pipe MMN communicates with the tube BC by the cavity round H; and its upper extremity P is furnished with a valve *a* opening upwards. An air-vessel KK is fastened to P, and the tube EGI is introduced into it so as to reach as near as possible to the valve *a*.

Fig. 99.



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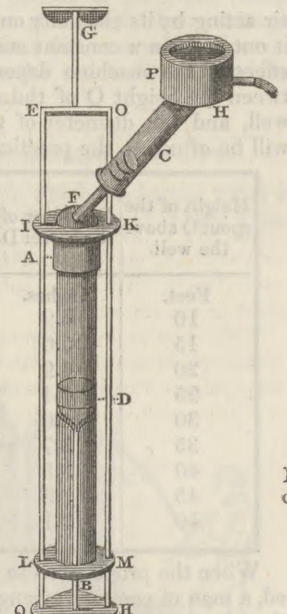
Let us now suppose the plunger D *g* to be depressed to *b*. As soon as it is elevated to C, the air below it will be rarefied, and the water will ascend through the valve *b* in the same way as in the sucking-pump, till the pipe is filled to C. The valve *b* will now be shut by the weight of the incumbent water; and therefore, when the plunger D *g* is depressed, it will force the water between C and *b* through the rectangular pipe MMN, into the air vessel KK. Before the water enters the air-vessel, it opens the valve *a*, which shuts as soon as the plunger is again raised, because the pressure of the water upon its under side is removed. In this way the water is driven into the air-vessel by repeated strokes of the plunger, till its surface is above the lower extremity of the pipe IG. Now, as the air in the vessel KK has no communication with the external air when the water is above I, it must be condensed more and more, as new quantities of water are injected. It will therefore endeavour to expand itself, and by pressing upon the surface H of the water in the air-vessel, it will drive the water through the tube IG, and make it issue at E in a continued stream, even when the plunger is rising to C. If the pipe GHI were joined to the pipe MMN at P, without the intervention of an air vessel, the stream of water would issue at F only when the plunger was depressed.

On Machines for raising Water.

Description of the lifting pump.

361. The lifting pump, which is only a particular modification of the forcing pump, is represented in fig. 100. The barrel AB is fixed in the immoveable frame KILM, the lower part of which is immersed in the water to be raised. The frame GEQHO consists of two strong iron rods EQ, OH, which move through holes in IK and LM, the upper and lower ends of the pump. To the bottom QH of this frame is fixed an inverted piston, with its bucket and valve uppermost at D. An inclined branch FH, either fixed to the top of the barrel, or moveable by a ball and socket, as represented at F, must be fitted to the barrel so exactly, as to resist the admission both of air and water. The branch FH is furnished with a valve C opening upwards. Let the pump be now plunged in the water to the depth of D. Then if the piston frame be thrust down into the fluid, the piston will descend, and the water by its upward pressure will open the valve at D, and gain admission above the piston. When the piston frame is elevated, it will raise the water above D along with it, and, forcing it through the valve, it will be carried off by the spout above H.

Fig. 100.



Mode of its operation.

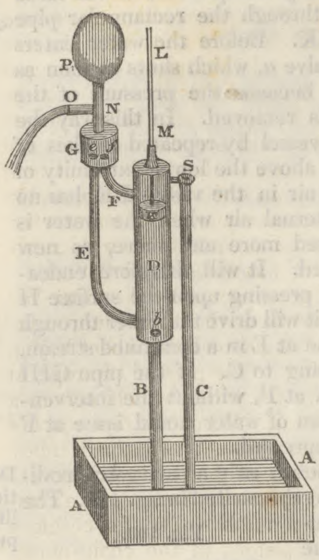
De la Hire's pump.

362. An ingenious pump, invented by De la Hire, is represented in fig. 101. It raises water equally quick by the descent as by the ascent of the piston. The pipes B, C, E, F, all communicate with the barrel MD, and have each a valve at their top, viz. at *b*, S, *e*, *f*. The piston rod LM and plunger K never rise higher than K, nor descend lower than D, KD being the length of the stroke. When the plunger K is raised from D to K, the pressure of the atmosphere forces the water through the valve *b*, and fills the barrel up to the plunger, in the very same way as in the forcing pump. When the plunger K is depressed to D, it forces the water between K and *b* up the pipe E, and through the valve *e* into the box G, where it issues at the spout O. During the descent of the plunger K, the valve *f* falls, and covers the top of the pipe F; and as the piston rod LM moves in a collar of leather at M, and is air-tight, the air above the plunger, between K and M, will be rare-

On Machines for raising Water.

fied, and likewise the air in the pipe CS, which communicates with the rarefied air by the valve S. The pressure of the air, therefore, will raise the water in CS, force it through the valve S, and fill the space above the plunger, expelling the rarefied air through the valve *f*. When the piston is raised from D to K, it will force the water through the bent pipe F into the box G, so that the same quantity of water will be discharged at O through the pipe F, during the ascent of the piston, as was discharged through the pipe E during the piston's descent. Above the pipe O is a close air-vessel P, so that when the water is driven above the spout O, it compresses the air in the vessel P, and this air acting by its elasticity on the surface of the water, forces it out at O in a constant and nearly equal stream. As the effect of the machine depends on a proper proportion between the height O of the spout above the surface of the well, and the diameter of the barrel, the following table will be of use to the practical mechanic.

Fig. 101.



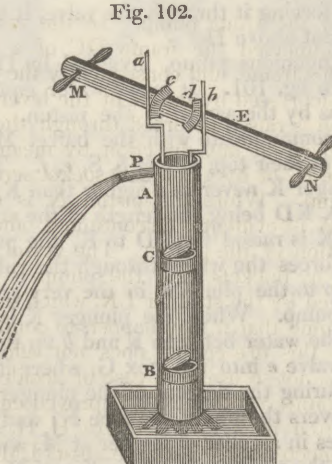
Height of the spout O above the well.	Diameter of the barrel D.	Height of the spout O above the well.	Diameter of the barrel D.
Feet.	Inches.	Feet.	Inches.
10	6.9	60	2.8
15	5.6	65	2.7
20	4.9	70	2.6
25	4.4	75	2.5
30	4.0	80	2.5
35	3.7	85	2.4
40	3.5	90	2.3
45	3.3	95	2.2
50	3.1	100	2.1

When the proportions in the preceding table are observed, a man of common strength will raise water much higher than he could do with a pump of the common construction.

Noble's pump.

363. A very simple pump, which furnishes a continued stream, is represented in fig. 102. It was invented by a Mr

Fig. 102.



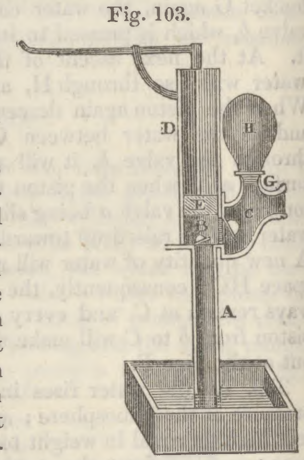
Noble, and consists of a working barrel AB, with two pistons C and B, which are moved up and down alternately by the rods fixed to the lever MN. The rod of the piston B passes through the piston C, and the piston C moves upon the rod AB. When the piston rod B is depressed and elevated, it will make the water rise in the barrel A, in the same way as in the sucking pump, whether the valve C be moveable or not. Let us now suppose that the water is raised to A. Then if the piston B is elevated by depressing the extremity N of the lever, the water at A will be raised higher in the barrel, and issue at the spout P; and when the same piston B is depressed by elevating the end N of the lever, the piston C is evidently raised, and the water above it will be expelled at P. This pump, therefore, will give a continued stream, for as the pistons ascend and descend alternately, one of them must always be forcing the water out at P. The pistons are elevated and depressed by means of toothed arches, *c* and *d*, working in the teeth of a rack, at the extremities *a*, *b* of the piston rod.

On Machines for raising Water.

Buchanan's pump.

364. The pump invented by Mr Buchanan is shewn in fig. 103. In the vertical section DGA, A is the suction barrel, D the working barrel, E the piston, G the spout, B the inner valve, and C the outer valve. These valves are of the kind called clack valves, and have their hinges generally of metal. It is easily seen that when the piston E is raised, the water will rise through the suction barrel A into the working barrel D, in the same way as in the sucking pump; and that when the piston E is depressed, it will force the water between it and the valve B, through the valve C, and make it issue at G. The points of difference between this pump and those of the common form, are,—that it discharges the water below the piston, and has its valves lying near each other. Hence the sand or mud which may be in the water, is discharged without injuring the barrel or the piston leathers; and as the valves B, C, may be of any size, they will transmit, without being choked, any rubbish which may rise in the suction barrels. If any obstruction should happen to the valves, they are within the reach of the workman's hand, and may be cleared without taking the pump to pieces. This simple machine may be quickly converted into a fire-engine, by adding the air-vessel H, which is screwed like a hosepipe, and by fixing in the spout G, a perforated stopple fitted to receive such pipes as are employed in fire-engines. When these additions are made, the water, as in the case of the forcing pump, will be driven into the air vessel H, and repelled through the perforated stopple G, by the elasticity of the included air.

Fig. 103.

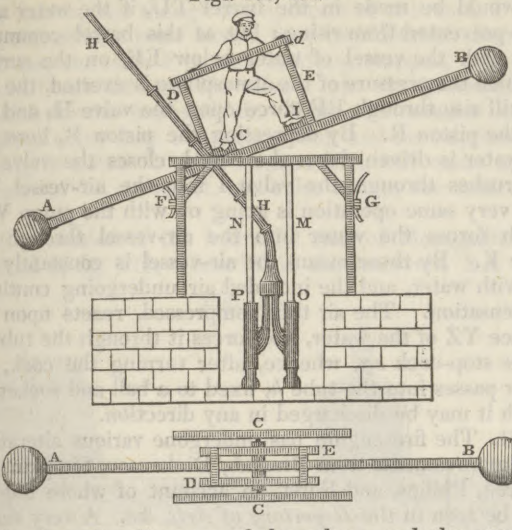


Balance pump.

365. A simple method of working two pumps at once, by means of a balance, is exhibited in fig. 104, where AB is the balance, having a large iron ball at each end, placed in equilibrium on the two spindles C, see fig. 105. The person who works the pump stands on two boards I, I, nailed to two cross pieces fastened to the axis of the machine, and supports himself by a cross bar D*d* joined to the two parts D, E. At the distance of ten inches on each side of the axis are suspended the iron rods M, N, to which the pistons are attached. The workman, by bearing alternately on the right and left foot, puts the balance in motion. The pistons M, N, are alternately elevated and depressed, and the water raised in the barrel of each is driven

into the pipe HH, in which it is elevated to a height pro-

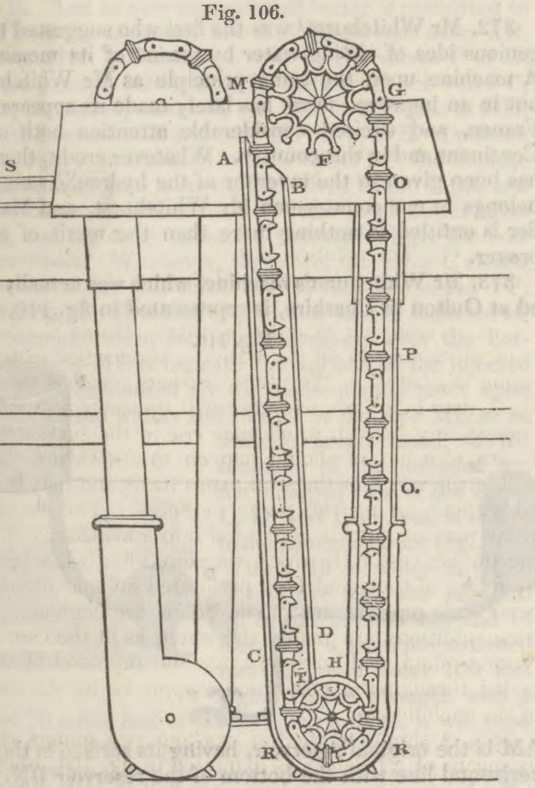
Figs. 104, 105.



portional to the diameter of the valves, and the power of the balance. In order to make the oscillations of the balance equal, and prevent it from acquiring too great a velocity, iron springs F, G, are fixed to the upright posts, which limit the length of its oscillations.

366. The chain pump is represented in fig. 106. It con-

Fig. 106.



sists of a chain MTHG, about 30 feet long, carrying a number of flat pistons M, N, O, P, Q, which are made to revolve in the barrels ABCD and GH, by driving the wheel F. When the flat pistons are at the lower part of the barrel T, they are immersed in the water RR, and as they rise in the barrel GH, they bring up the water along with them into the reservoir MG, from which it is conveyed by the spout S. The teeth of the wheel F are so contrived as to receive one-half of the flat pistons, and let them fold in; and sometimes another wheel like F is fixed at the bottom D. The distance of the pistons from the side of the barrel is about half an inch; but as the machine is generally worked with great velocity, the ascending pistons bring along with them into the reservoir as much water as fills the cavity GH. Sometimes chain pumps are constructed without the barrels ABCD and GH. In this case, the flat pistons are converted into buckets connected with a chain, which dip in the water with their mouths downwards, and convey it to the reservoir. The buckets are moved by hexagonal axles, and the distance between each is nearly equal to the depth of the buckets. Chain pumps are frequently placed in an inclined position, and in this position they raise the greatest quantity of water when the distance of the flat pistons is equal to their breadth, and when the inclination of the barrels is about 24° 21′.

On Machines for raising Water.

367. The hair-rope machine, invented by the Sieur Vera, operates on the same principle as the chain-pump. Instead of a chain of pistons moving round the wheel F (fig. 106.), a hair-rope is substituted. The part of the rope at T that is lowest always dips in the water, which, adhering to the rope, is raised along with it. When the rope reaches the top at G and M, it passes through two small tubes, which, being fixed in the bottom of the reservoir, prevent the water from returning into the well. Sometimes a common rope is employed, having a number of stuffed cushions fixed to it instead of the flat pistons in the chain-pump. These cushions carry the water along with them through the barrel HG, and deliver it into the reservoir.—For the description of other pumps, see the article Pump; and for pump mills, see the article Mill.

Hair-rope machine of the Sieur Vera.

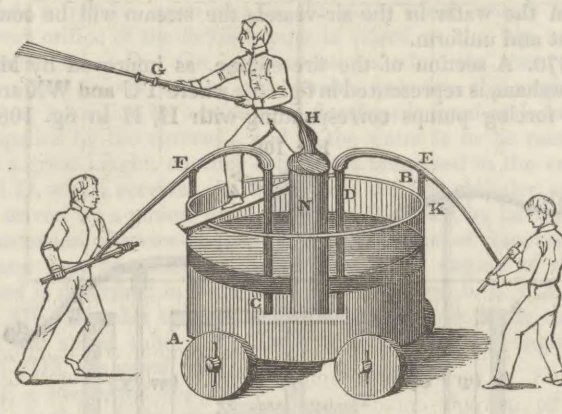
Machine with cushions instead of flat pistons.

Sect. II. *On Engines for Extinguishing Fire.*

368. The common fire-engine which discharges water in successive jets is represented in fig. 107, and is only a mo-

Common squirting engine.

Fig. 107.



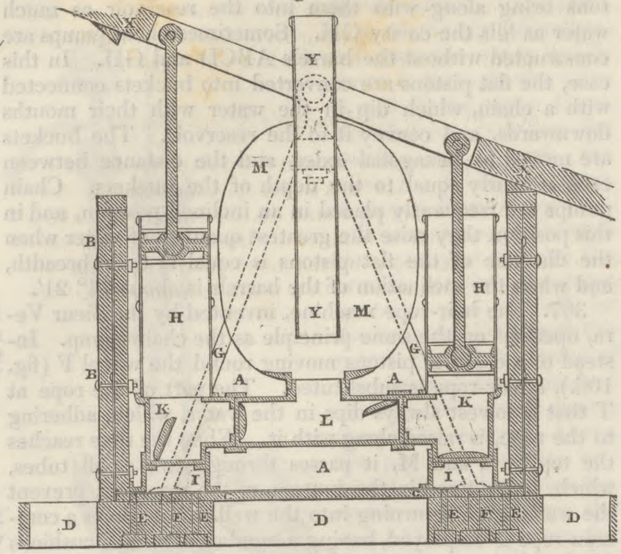
dification of the lifting pump. In the vessel AB, full of water, is immersed the frame DC of a common lifting pump. This frame, and consequently the piston N, is elevated and depressed by means of the levers E, F, and the water which is raised is forced through the pipe G, which may be moved in any direction by means of the elastic leather pipe H, or by a ball and socket screwed on the top of the pump. While the piston N is descending, the stream at G is evidently discontinued, and issues only at each elevation of the piston. The vessel AB is supplied with water by buckets, and the pump is prevented from being choked by the strainer LK, which separates from the water any mud that it may happen to contain.

369. As this fire-engine does not afford a continued stream, it is not so useful in case of accidents as when the stream is uninterrupted. An improved engine of this sort is represented in fig. 108, where H, H, are two forcing pumps connected with the large vessel LMM, and wrought by the levers X, X, moving upon Y as a fulcrum. This

Improved fire-engine.

apparatus is plunged and fastened in a vessel I I partly

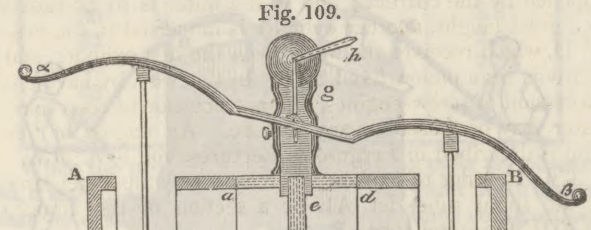
Fig. 108.



filled with water, and by means of the forcing pumps H, H, the operation of which has already been described, the water is raised through the valves above I I, and driven through the valves A, A into the large vessel LMM, where the included air is condensed. Into this vessel is inserted the tube YY, communicating with the leathern hose which carries off the water. The elasticity of the condensed air in the vessel LMM pressing upon the surface of the water in that vessel, forces it up through the tube YY into the leathern pipe, from whose extremity it issues with great force and velocity; and as the condensed air is continually pressing upon the water in the air-vessel, the stream will be constant and uniform.

Newsham's fire-engine. 370. A section of the fire-engine, as improved by Mr Newsham, is represented in fig. 109, where TU and WX are the forcing pumps corresponding with H, H in fig. 108,

Fig. 109.



YZ the large vessel corresponding with LMM, and *ef* the tube corresponding with YY. The vessels TU, WX, YZ, the horizontal canals ON, QP, ML, and the vertical canal EE, all communicate with each other by means of four valves O, I, K, P opening upwards, and the vertical pipe is immersed in the water to be raised. When the piston R is raised by means of the double lever $\alpha\beta$, a vacuum would be made in the barrel TU, if the water at R were prevented from rising; but as this barrel communicates with the vessel of water below EF, on the surface of which the pressure of the atmosphere is exerted, the water will rise through EF, force open the valve H, and follow the piston R. By depressing the piston R, however, the water is driven down the barrel, closes the valve H, and rushes through the valve I into the air-vessel YZ. The very same operation is going on with the pump WX, which forces the water into the air-vessel through the valve K. By these means the air-vessel is constantly filling with water, and the included air undergoing continual condensation. The air thus compressed, reacts upon the surface YZ of the water, and forces it through the tube *ef* to the stop-cock *eg*, whence, after turning the cock, the water passes into the tube *h*, fixed to a ball and socket, by which it may be discharged in any direction.

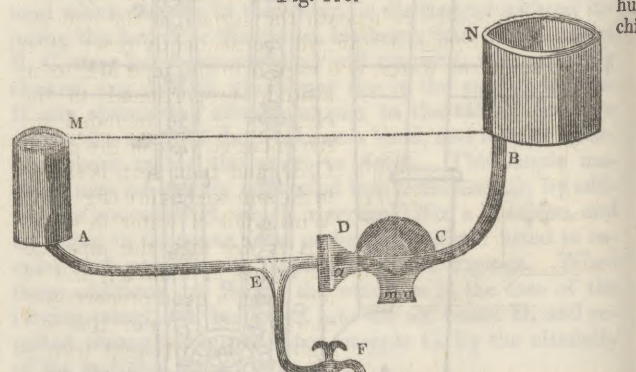
371. The fire-engine has undergone various alterations and improvements from Bramah, Dickenson, Simpkin, Raventree, Philips, and Furst, an account of whose engines may be seen in the *Repertory of Arts*, &c. A very simple and cheap fire-engine has been invented by Mr B. Dearborn, and is described in the *American Transactions* for 1794, and in *Gregory's Mechanics*, vol. ii. p. 177. Referen[ces] to the i[m]provements.

SECT. III. *On Whitehurst's Machine, and Montgolfier's Hydraulic Ram.*

372. Mr Whitehurst[1] was the first who suggested the ingenious idea of raising water by means of its momentum. A machine upon the same principle as Mr Whitehurst's, but in an improved form, has lately made its appearance in France, and excited considerable attention both on the Continent and in this country. Whatever credit, therefore, has been given to the inventor of the hydraulic ram, justly belongs to our countrymen Mr Whitehurst, and Montgolfier is entitled to nothing more than the merit of an improver. The id[ea] of raisi[ng] water b[y] its own [mo]mentu[m] first su[g]gested [by] Mr W[hite]hurst.

373. Mr Whitehurst's machine, which was actually erected at Oulton in Cheshire, is represented in fig. 110, where Descr[ip]tion o[f] Whit[e]hurst'[s ma]chine.

Fig. 110.



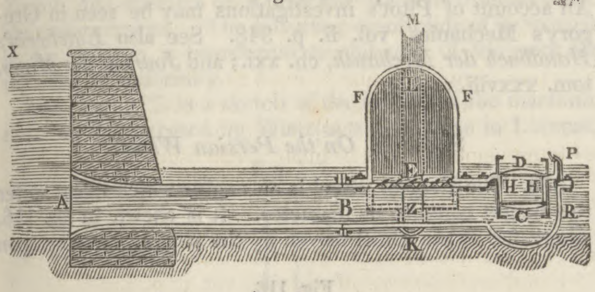
AM is the original reservoir, having its surface in the same horizontal line with the bottom of the reservoir BN. The diameter of the main pipe AE is one inch and a half, and its length about 200 yards; and the branch pipe EF is of such a size that the height of the surface M of the reservoir is nearly 16 feet above the cock F. In the valve box D is placed the valve *a*, and into the air-vessel C are inserted the extremities *m*, *n* of the main pipe, bent downwards to prevent the air from being driven out when the water is forced into it. Now as the cock F is 16 feet below the reservoir AM, the water will issue from F with a velocity

[1] *Philosophical Transactions*, 1775.

of nearly 30 feet per second. As soon as the cock F therefore is opened, a column of water 200 yards long is put in motion, and though the aperture of the cock F be small, this column must have a very considerable momentum. Let the cock F be now suddenly stopped, and the water will rush through the valve a into the air-vessel C, and condense the included air. This condensation must take place every time the cock is shut, and the imprisoned air being in a state of high compression, will react upon the water in the air-vessel, and raise it into the reservoir BN.

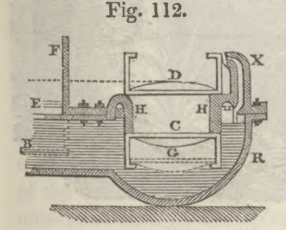
374. A section of the hydraulic ram of Montgolfier is exhibited in fig. 111, where X is the reservoir, XA the

Fig. 111.



height of the fall, and AB the horizontal canal which conveys the water to the engine MFKR. C and D are two valves, and ME a pipe reaching within a very little of the bottom E. Let us now suppose that water is permitted to descend from the reservoir. It will evidently rush along AB, and out at HH, which can be shut by the valves C or D. When the passage HH is shut by the rise of the valve C, the water is suddenly checked, and, unable to escape at HH, it will rush forwards to Z and raise the valves at E. A portion of water being thus admitted into the vessel FF, the impulse of the column of fluid is spent, the valves D and C fall, and the water issues at HH as before; when its motion is again checked, and the same operation repeated which has now been described. Whenever, therefore, the valve C closes, a portion of water will force its way into the vessel FF, and condense the air which it contains, for the included air has no communication with the atmosphere after the bottom of the pipe ME is beneath the surface of the injected water. This condensed air will consequently react upon the surface of the water, and raise it in the pipe ME to an altitude proportioned to the elasticity of the included air. An enlarged view of the valves C, D, and their seat, is shewn in the annexed figure (fig. 112). With a fall of water in which XA is *five* feet, the pipe AB *six* inches in diameter, and 14 feet long, a good proportioned ram will raise water 100 feet high. When wrought with a power of 70 cubic feet of water in the minute, it will raise $2\frac{1}{2}$ cubic feet of water per minute to the height of 100 feet. One of these machines is stated to have raised 100 hogsheads of water in 24 hours to the height of 134 feet, and a fall of only $4\frac{1}{2}$ feet. From this description it will be seen, that the only difference between the engines of Montgolfier and Whitehurst is, that the one requires a person to turn the cock, while the other has the advantage of acting spontaneously. Montgolfier[1] assures us, that the honour of this invention does not belong to England, but that he is the sole inventor, and did not receive a hint from any person whatever.—It would appear from some experiments made by Montgolfier, that the effect of the water-ram is equal to between a half and three-fourths of the power expended, which renders it superior to most hydraulic machines.[2]

Fig. 112.

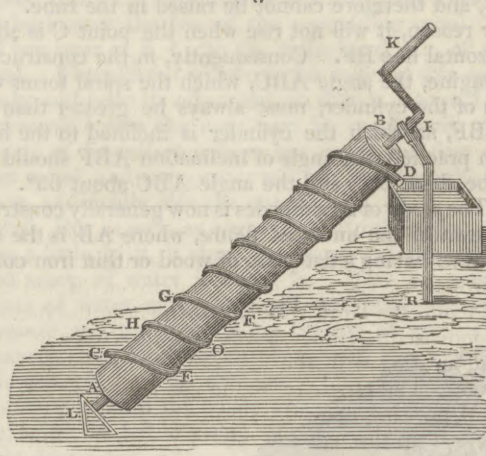


Sect. IV. *On Archimedes's Screw-Engine.*

Description of Archimedes's screw-engine.

375. The screw-engine invented by Archimedes is represented in fig. 113, where AB is a cylinder with a flexible pipe, CEHOGF, wrapped round its circumference like a screw. The cylinder is inclined to the horizon, and supported at one extremity by the bent pillar IR, while its other extremity, furnished with a pivot, is immersed in the

Fig. 113.

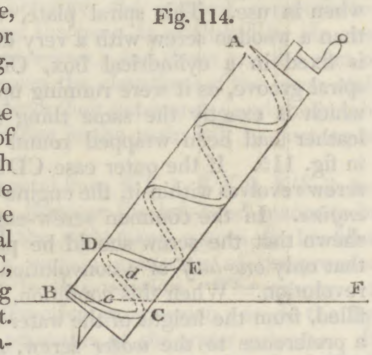


water. When, by means of the handle K, the cylinder is made to revolve upon its axis, the water which enters the lower orifice of the flexible pipe is raised to the top, and discharged at D. On some occasions, when the water to be raised moves with a considerable velocity, the engine is put in motion by a number of floatboards fixed at L, and impelled by the current; and if the water is to be raised to a great height, another cylinder is immersed in the vessel D, which receives the water from the first cylinder, and is driven by a pinion fixed at I. In this way, by having a succession of screw-engines, and a succession of reservoirs, water may be raised to any altitude. An engine of this kind is described in Ferguson's Lectures, vol. ii. p. 113.

Operation of the screw-engine.

376. In order to explain the reason why the water rises in the spiral tube, let AB be a section of the engine, BCdDE the spiral tube, BF a horizontal line or the surface of the stagnant water which is to be raised, and ABF the angle which the axis of the cylinder makes with the horizon. Then, the water which enters the extremity B of the spiral tube will descend to C, and remain there as long as the cylinder is at rest. But if a motion of rotation be communicated to the cylinder, so that the lowest part C of the spiral BCD moves towards B, and the points d, D, E towards C, and become successively the lowest parts of the spiral, the water must occupy successively the

Fig. 114.



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[1] *Cette invention n'est point originaire d'Angleterre, elle appartient toute entiere à la France. Je declare que j'en suis le seul inventeur, et que l'idée ne m'en a eté fournie par personnes.* Journal des Mines, vol. xiii. No. 73.

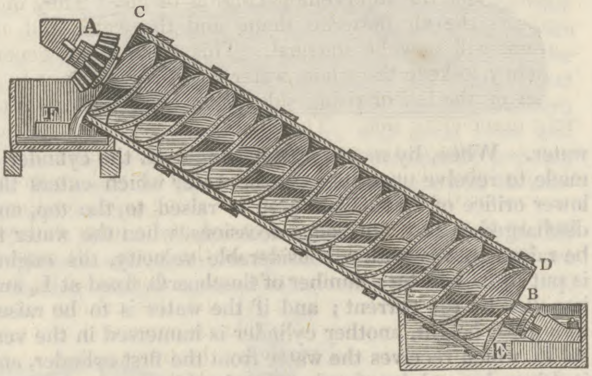
[2] See *Appendix to Ferguson's Lectures; Repertory of Arts,* Dec. 1816; and *Journal of the Royal Institution,* vol. i. p. 211.

On Machines for raising water.

points d, D, E, and therefore rise in the tube; or, which is the same thing, when the point C moves to c, the point d will be at C; and as the water at C cannot rise along with the point C to c, on account of the inclination of Cc to the horizon, it must occupy the point d of the spiral, when C has moved to c; that is, the water has a tendency to occupy the lower parts of the spiral, and the rotatory motion withdraws this part of the spiral from the water, and causes it to ascend to the top of the tube. By wrapping a cord round a cylinder, and inclining it to the horizon, so that the angle ABC may be greater than the angle ABF, and then making it revolve upon its axis, the preceding remarks will be clearly illustrated.—If the direction of the spiral BC should be horizontal, that is, if it should coincide with the line BF, the water will have no tendency to move towards C, and therefore cannot be raised in the tube. For a similar reason, it will not rise when the point C is above the horizontal line BF. Consequently, in the construction of this engine, the angle ABC, which the spiral forms with the side of the cylinder, must always be greater than the angle ABF, at which the cylinder is inclined to the horizon. In practice, the angle of inclination ABF should generally be about 50°, and the angle ABC about 65°.

377. The screw of Archimedes is now generally constructed as shewn in the annexed figure, where AB is the axis of the screw, having a flat plate of wood or thin iron coiled,

Fig. 115.



as it were, round the axis, like a spiral, or the threads of a screw. The plane of this plate is perpendicular to the surface of the cylindrical axis AB, but is inclined to the direction of the axis at an angle which must always be greater than the angle which the axis AB forms with the horizon when in use. This spiral plate, which is nothing more than a wooden screw with a very deep and narrow thread, is fixed in a cylindrical box, CDEF, so as to form a spiral groove, as it were running up the tube from B to A, which is exactly the same thing as if a pipe of lead or leather had been wrapped round the cylindrical axis, as in fig. 115. If the outer case CDEF is fixed so that the screw revolves within it, the engine is called a *water screw-engine.* In the common screw-engine, Mr Eytelwein has shewn that the screw should be placed in such a manner that only *one-half* of a convolution may be filled at each revolution. When this condition, however, cannot be fulfilled, from the height of the water being variable, he gives a preference to the *water* screw, notwithstanding that in this case one-third of the water generally runs back, and the screw is apt to become clogged by impurities or weeds.

378. In a screw-engine erected at the Hurlet Alum Works, for raising the alum liquor, the length of the screw is 127 feet, its inclination to the horizon 37° 36′; the height to which it raises the liquor 76 feet 9 inches, the octagonal axis of the screw 8 inches in diameter, the diameter of the spiral 22 inches, the thickness of the covering 2 inches, the distance of the threads 9 inches, the number of the threads 168, the thickness of the spiral 2 inches, the width and depth of the spiral tube 7 inches each. The screw is sustained upon five sets of pivots or rollers, each set consisting of two rollers. The engine is driven by a water-wheel, which performs *one* revolution while the screw performs *two.* The quantity of liquor raised is 70 wine gallons; and as its specific gravity is 1.065, the quantity discharged in an hour is 17 tons. The screw is built wholly of wood, as the alum liquor acts upon iron.

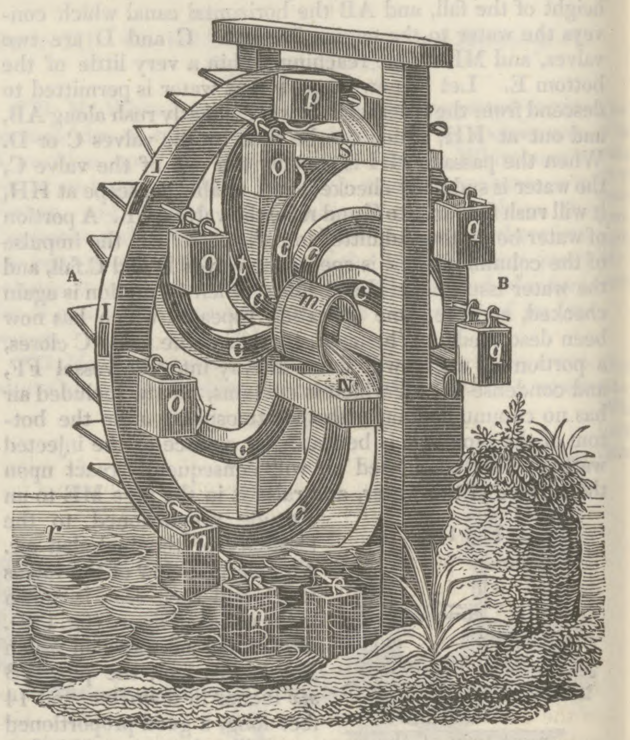
379. The theory of this engine is treated at great length by Hennert, in his *Dissertation sur la vis d'Archimede*, Berlin, 1767; by Pitot, in the *Memoirs of the French Academy*; and by Euler, in the *Nov. Comment. Petrop.* tom. v. An account of Pitot's investigations may be seen in Gregory's Mechanics, vol. ii. p. 348. See also *Eytelwein's Handbuch der Mechanik*, ch. xxi.; and *Journal des Mines*, tom. xxxviii. p. 321.

Sect. V. *On the Persian Wheel.*

Description of the Persian Wheel.

380. The Persian wheel is an engine which raises water to a height equal to its diameter. It is shewn in fig. 116, where AB is the wheel driven by the stream r acting upon

Fig. 116.



floatboards fixed on one side of its rim. A number of buckets, n, o, p, q, are disposed on the opposite side of the rim, and suspended by strong pins. When the wheel is in motion, the descending buckets q, q immerge into the stream, and ascend full of water till they reach the top at p, where they strike against the extremity of the fixed reservoir S, and being overset, discharge their contents into that reservoir. As soon as the bucket quits the reservoir, it resumes its perpendicular position by its own weight and descends as before. On each bucket is fixed a spring t, t, which moves over the top of the bar fastened to the reservoir S. By this means the bottom of the bucket is raised above the level of its mouth, and its contents completely discharged.

381. On some occasions the Persian wheel is made to

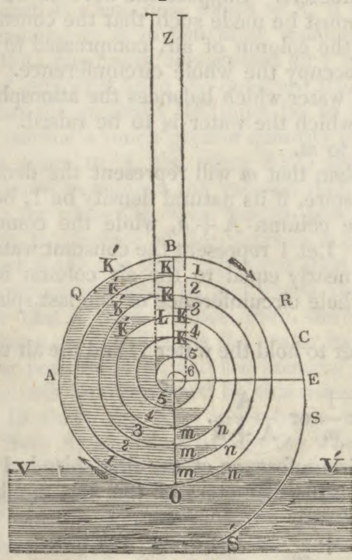
raise water only to the height of its axle. In this case, instead of buckets, its spokes, C, C, C, C, &c., are made of a spiral form, and hollow within, so that their inner extremities all terminate in the box N on the axle, and their outer extremities in the circumference of the wheel. When the rim AB, therefore, is immersed in the stream, the water runs into the tubes I, I, &c., rises in the spiral spokes C, C, C, &c., and is discharged from the orifices within *m* into the reservoir N, from which it may be conveyed in pipes.

Sect. VI. *On the Zurich Machine.*

382. This machine is a kind of pump invented and erected by H. Andreas Wirtz, an ingenious tin-plate worker in Zurich, and operates on a principle different from all other hydraulic engines. The following description of it, written by Dr Robison, is transferred to this part of the work for the sake of uniformity.

383. Fig. 117. is a sketch of the section of the machine, as it was first erected by Wirtz at a dye-house in Limmat,

Fig. 117.



in the suburbs or vicinity of Zurich. It consists of a hollow cylinder, like a very large grindstone, turning on a horizontal axis, and partly plunged in a cistern of water. The axis is hollow at one end, and communicates with a perpendicular pipe CBZ, part of which is hid by the cylinder. This cylinder or drum is formed into a spiral canal by a plate coiled up within it like the main-spring of a watch in its box; only the spires are at a distance from each other, so as to form a conduit for the water of uniform width. This spiral partition is well joined to the two ends of the cylinder, and no water escapes between them. The outermost turn of the spiral begins to widen about three-fourths of a circumference from the end, and this gradual enlargement continues from Q to S nearly a semicircle: this part may be called the Horn. It then widens suddenly, forming a Scoop or shovel SS′. The cylinder is supported so as to dip several inches into the water, whose surface is represented by VV′.

384. When this cylinder is turned round its axis in the direction ABEO, as expressed by the two darts, the scoop SS′ dips at V′ and takes up a certain quantity of water before it immerges again at V. This quantity is sufficient to fill the taper part SQ, which we have called the Horn; and this is nearly equal in capacity to the outermost uniform spiral round.

385. After the scoop has emerged, the water passes along the spiral by the motion of it round the axis, and drives the air before it into the rising-pipe, where it escapes.—In the mean time, air comes in at the mouth of the scoop; and when the scoop again dips into the water, it again takes in a similar quantity. Thus there is now a part filled with water and a part filled with air. Continuing this motion, we shall receive a second round of water and another of air. The water in any turn of the spiral will have its two ends on a level; and the air between the successive columns of water will be in its natural state; for since the passage into the rising pipe or Main is open, there is nothing to force the water and air into any other position. But since the spires gradually diminish in their length, it is plain that the column of water will gradually occupy more and more of the circumference of each. At last it will occupy a complete turn of some spiral that is near the centre; and when sent farther in, by the continuance of the motion, some of it will run back over the top of the succeeding spiral. Thus it will run over at K 4 into the right-hand side of the third spiral. Therefore it will push the water of this spire backwards, and raise its other end, so that it also will run over backwards *before* the next turn be completed. And this change of disposition will at last reach the first or outermost spiral, and some water will run over into the horn and scoop, and finally into the cistern.

On Machines for raising Water.

386. But as soon as water gets into the rising pipe, and rises a little in it, it stops the escape of the air when the next scoop of water is taken in. Here are now two columns of water acting against each other by hydrostatic pressure and the intervening column of air. They must compress the air between them, and the water and air-columns will now be unequal. This will have a general tendency to keep the whole water back, and cause it to be higher on the left or rising side of each spire than on the right descending side. The excess of height will be just such as produces the compression of the air between that and the preceding column of water. This will go on increasing as the water mounts in the rising pipe; for the air next to the rising pipe is compressed at its inner end with the weight of the whole column in the main. It must be as much compressed at its outer end. This must be done by the water column without it; and this column exerts this pressure partly by reason that *its* outer end is higher than its inner end, and partly by the transmission of the pressure on its outer end by air, which is similarly compressed from without. And thus it will happen that each column of water, being higher at its outer than at its inner end, compresses the air on the water column beyond or within it, which transmits this pressure to the air beyond it, adding to it the pressure arising from its own want of level at the ends. Therefore, the greatest compression, viz. that of the air next the main, is produced by *the sum of all the transmitted pressures;* and these are the sum of all the differences between the elevations of the inner ends of the water columns above their outer ends: and the height to which the water will rise in the main will be just equal to this sum.

387. Draw the horizontal lines K′K 1, K′K 2, K′K 3, &c. and *mn*, *mn*, *mn*, &c. Suppose the left-hand spaces to be filled with water, and the right-hand spaces to be filled with air. There is a certain gradation of compression which will keep things in this position. The spaces evidently decrease in arithmetical progression; so do the hydrostatic heights and pressures of the water columns. If, therefore, the air be dense in the same progression, all will be in hydrostatical equilibrium. Now this is evidently producible by the mere motion of the machine; for since the density and compression in each air column is supposed inversely as the bulk of the column, the absolute quantity of air is the same in all; therefore the column first taken in will pass gradually inwards, and the increasing compression will cause it to occupy precisely the whole right-hand side

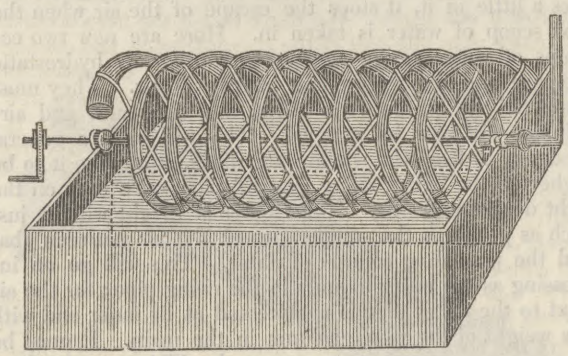
On Machines for raising Water.

of every spire. The gradual diminution of the water columns will be produced during the motion by the water running over backwards at the top, from spire to spire, and at last coming out by the scoop.

388. It is evident that this disposition of the air and water will raise the water to the greatest height, because the hydrostatic height of each water column is the greatest possible, viz. the diameter of the spire. This disposition may be obtained in the following manner: Take CL to CB as the density of the external air to its density in the last column next the rising pipe or main; that is, make CL to CB as 33 feet (the height of the column of water which balances the atmosphere), to the sum of 33 feet and the height of the rising pipe. Then divide BL into such a number of turns, that the sum of their diameters shall be equal to the height of the main; then bring a pipe straight from L to the centre C. The reason of all this is very evident.

389. But when the main is very high, this construction will require a very great diameter of the drum, or many turns of a very narrow pipe. In such cases it will be much better to make the spiral in the form of a cork-screw, as in fig. 118. instead of this flat form like a watch-spring. The

Fig. 118.



pipe which forms the spiral may be lapped round the frustum of a cone, whose greatest diameter is to the least (which is next to the rising pipe) in the same proportion that we assigned to CB and CL. By this construction the water will stand in every round so as to have its upper and lower surfaces tangents to the top and bottom of the spiral, and the water columns will occupy the whole ascending side of the machine, while the air occupies the descending side.

390. This form is vastly preferable to the flat one: it will allow us to employ many turns of a large pipe, and therefore produce a great elevation of a large quantity of water.

The same thing will be still better done by lapping the pipe on a cylinder, and making it taper to the end, in such a proportion that the contents of each round may be the same as when it is lapped round the cone. It will raise the water to a greater height (but with an increase of the impelling power) by the same number of turns, because the vertical or pressing height of each column is greater.

Nay, the same thing may be done in a more simple manner, by lapping a pipe of uniform bore round a cylinder. But this will require more turns, because the water columns will have less differences between the heights of their two ends. It requires a very minute investigation to show the progress of the columns of air and water in this construction, and the various changes of their arrangement, before one is attained which will continue during the working of the machine.

391. We have chosen for the description of the machine that construction which made its principle and manner of working most evident, namely, which contained the same material quantity of air in each turn of the spiral, more and more compressed as it approaches to the rising pipe. We should otherwise have been obliged to investigate in great detail the gradual progress of the water, and the frequent changes of its arrangement, before we could see that one arrangement would be produced which would remain constant during the working of the machine. But this is not the best construction. We see that, in order to raise water to the height of a column of 34 feet, which balances the atmosphere, the air in the last spire is compressed into half its bulk; and the quantity of water delivered into the main at each turn is but half of what was received into the first spire, the rest flowing back from spire to spire, and being discharged at the spout.

392. But it may be constructed so as that the quantity of water in each spire may be the same that was received into the first; by which means a greater quantity (double in the instance now given) will be delivered into the main, and raised to the same height by very nearly the same force.—This may be done by another proportion of the capacity of the spires, whether by a change of their caliber or of their diameters. Suppose the bore to be the same, the diameter must be made such that the constant column of water, and the column of air, compressed to the proper degree, may occupy the whole circumference. Let A be the column of water which balances the atmosphere, and h the height to which the water is to be raised. Let A be to $A+h$ as 1 to m.

393. It is plain that m will represent the density of the air in the last spire, if its natural density be 1, because it is pressed by the column $A+h$, while the common air is pressed by A. Let 1 represent the constant water column, and therefore nearly equal to the air column in the first spire. The whole circumference of the last spire must be $1+\frac{1}{m}$, in order to hold the water 1, and the air compressed into the space $\frac{1}{m}$ or $\frac{A}{A+h}$.

394. The circumference of the first spire is $1+1$ or 2. Let D and d be the diameters of the first and last spires; we have $2:1+\frac{1}{m}=D:d$, or $2\,m:m+1=D:d$. Therefore, if a pipe of uniform bore be lapped round a cone, of which D and d are the end diameters, the spirals will be very nearly such as will answer the purpose. It will not be quite exact, for the intermediate spirals will be somewhat too large. The conoidal frustum should be formed by the revolution of a curve of the logarithmic kind. But the error is very trifling.

With such a spiral, the full quantity of water which was confined in the first spiral will find room in the last, and will be sent into the main at every turn. This is a very great advantage, especially when the water is to be much raised. The saving of power by this change of construction is always in proportion to the greatest compression of the air.

The great difficulty in the construction of any of these forms is in determining the form and position of the horn and the scoop; and on this greatly depends the performance of the machine. The following instructions will make it pretty easy.

395. Let ABEO (fig. 119.) represent the first or outermost round of the spiral, of which the axis is C. Suppose it immerged up to the axis in the water VV, we have seen that the machine is most effective when the surfaces KB and O n of the water columns are distant the whole diameter BO of the spiral. Therefore, let the pipe be first supposed of equal calibre to the very mouth E e, which we suppose to be just about to dip into the water. The sur-

Fig. 1[19.]

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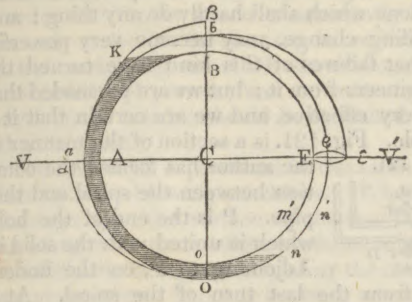
face O n is kept there, in opposition to the pressure of the water column BAO, by the compressed air contained in

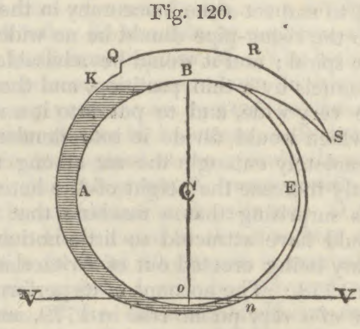
Fig. 119.



the quadrant OE, and in the quadrant which lies behind EB. And this compression is supported by the columns behind, between this spire and the rising pipe. But the air in the outermost quadrant EB is in its natural state, communicating as yet with the external air. When, however, the mouth E ε has come round to A, it will not have the water standing in it in the same manner, leaving the half space BEO filled with compressed air; for it took in and confined only what filled the quadrant BE. It is plain, therefore, that the quadrant BE must be so shaped as to take in and confine a much greater quantity of air; so that when it has come to A, the space BEO may contain air sufficiently dense to support the column AO. But this is not enough: for when the wide mouth, now at A α, rises up to the top, the surface of the water in it rises also, because the part Ao O a is more capacious than the cylindric part OE $e\,o$ which succeeds it, and which cannot contain all the water that it does. Since, then, the water in the spire rises above A, it will press the water back from O n to some other position $m'\,n'$, and the pressing height of the water-column will be diminished by this rising on the other side of O. In short, the horn must begin to widen, not from B but from A, and must occupy the whole semicircle ABE; and its capacity must be to the capacity of the opposite cylindrical side as the sum of BO, and the height of a column of water which balances the atmosphere to the height of that column. For then the air which filled it, when of the common density, will fill the uniform side BEO, when compressed so as to balance the vertical column BO. But even this is not enough; for it has not taken in enough of water. When it dipped into the cistern at E, it carried air down with it, and the pressure of the water in the cistern caused the water to rise into it a little way; and some water must have come over at B from the other side, which was drawing narrower. Therefore, when the horn is in the position EOA, it is not full of water. Therefore, when it comes into the situation OAB, it cannot be full nor balance the air on the opposite side. Some will therefore come out at O, and rise up through the water. The horn must, therefore, 1st, Extend at least from O to B, or occupy half the circumference; and, 2dly, It must contain at least twice as much water as would fill the side BEO. It will do little harm though it be much larger; because the surplus of air which it takes in at E will be discharged, as the end E e of the horn rises from O to B, and it will leave the precise quantity that is wanted. The overplus water will be discharged as the horn comes round to dip again into the cistern. It is possible, but requires a discussion too intricate for this place, to make it of such a size and shape, that while the mouth moves from E to B, passing through O and A, the suface of the water in it shall advance from E ε to O n, and be exactly at O when the beginning or narrow end of the horn arrives there.

400. We must also secure the proper quantity of water. When the machine is so much immersed as to be up to the axis in water, the capacity which thus secures the proper quantity of air will also take in the proper quantity of water. But it may be erected so as that the spirals shall not even reach the water. In this case it will answer our purpose if we join to the end of the horn a scoop or shovel QRSB (fig. 120.), which is so formed as to take in at least

Fig. 120.



as much water as will fill the horn. This is all that is wanted in the beginning of the motion along the spiral, and more than is necessary when the water has advanced to the succeeding spire; but the overplus is discharged in the way we have mentioned. At the same time, it is needless to load the machine with more water than is necessary, merely to throw it out again. We think that if the horn occupies fully more than one-half of the circumference, and contains as much as will fill the whole round, and if the scoop lifts as much as will certainly fill the horn, it will do very well.

The scoop must be very open on the side next the axis, that it may not confine the air as soon as it enters the water. This would hinder it from receiving water enough.

401. The following dimensions of a machine erected at Florence, and whose performance corresponded extremely well with the theory, may serve as an example.

The spiral is formed on a cylinder of ten feet diameter, and the diameter of the pipe is six inches. The smaller end of the horn is of the same diameter; it occupies three-fourths of the circumference, and is $7\frac{8}{10}$ths inches wide at the outer end. Here it joins the scoop, which lifts as much water as fills the horn, which contains 4340 Swedish cubic inches, each = 1.577 English. The machine makes six turns in a minute, and raises 1354 pounds of water, or 22 cubic feet, 10 feet high in a minute.

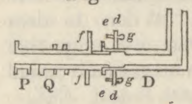
402. The above account will, we hope, sufficiently explain the manner in which this singular hydraulic machine produces its effect. When every thing is executed by the maxims which we have deduced from its principles, we are confident that its performance will correspond to the theory; and we have the Florentine machine as a proof of this. It raises more than ten-elevenths of what the theory promises, and it is not perfect. The spiral is of equal caliber, and is formed on a cylinder. The friction is so inconsiderable in this machine, that it need not be minded: but the great excellency is, that whatever imperfection there may be in the arrangement of the air and water columns, this only affects the elegance of the execution, causing the water to make a few more turns in the spiral before it can mount to the height required; but wastes no power, because the power employed is always in proportion to the sum of the vertical columns of water in the rising side of the machine; and the height to which the water is raised by it is in the very same proportion. It should be made to move very slow, that the water be not always dragged up by the pipes, which would cause more to run over from each column, and diminish the pressure of the remainder.

403. If the rising-pipe be made wide, and thus room be made for the air to escape freely up through the water, it will rise to the height assigned; but if it be narrow, so that the air cannot get up, it rises almost as slow as the

On Machines for raising Water.

water, and by this circumstance the water is raised to a much greater height mixed with air, and this with hardly any more power. It is in this way that we can account for the great performance of the Florentine machine, which is almost triple of what a man can do with the finest pump that ever was made: indeed, the performance is so great, that one is apt to suspect some inaccuracy in the accounts. The entry into the rising-pipe should be no wider than the last part of the spiral; and it would be advisable to divide it into four channels by a thin partition, and then to make the rising-pipe very wide, and to put into it a number of slender rods, which would divide it into slender channels that would completely entangle the air among the water. This will greatly increase the height of the heterogeneous column. It is surprising that a machine that is so very promising should have attracted so little notice. We do not know of any being erected out of Switzerland, except at Florence in 1778. The account of its performance was in consequence of a very public trial in 1779, and honourable declaration of its merit, by Sig. Lorenzo Ginori, who erected another, which fully equalled it. It is shortly mentioned by Professor Sulzer of Berlin, in the *Sammlungen Vermischlen Schristen* for 1754. A description of it is published by the Philosophical Society at Zurich in 1766, and in the descriptions published by the Society in London for the encouragement of Arts in 1776. The celebrated Daniel Bernoulli has published a very accurate theory of it in the Petersburgh Commentaries for 1772, and the machines at Florence were erected according to his instructions. Baron Alstromer in Sweden caused a glass model of it to be made, to exhibit the internal motions for the instruction of artists, and also ordered an operative engine to be erected; but we have not seen any account of its performance. It is a very intricate machine in its principles; and an ignorant engineer, nay the most intelligent, may erect one which shall hardly do any thing; and yet by a very trifling change, may become very powerful. We presume that failures of this kind have turned the attention of engineers from it; but we are persuaded that it may be made very effective, and we are certain that it must be very durable. Fig. 121. is a section of the manner in which the author has formed the communication between the spiral and the rising-pipe. P is the end of the hollow axis which is united with the solid iron axis. Adjoining to P, on the under side, is the entry from the last turn of the spiral. At Q is the collar which rests on the supports, and turns round in a hole of bell-metal. *f f* is a broad flanch cast in one piece with the hollow part. Beyond this the pipe is turned somewhat smaller, very round and smooth, so as to fit into the mouth of the rising-pipe, like the key of a cock. This mouth has a plate *e e* attached to it. There is another plate *d d*, which is broader than *e e*, and is not fixed to the cylindrical part, but moves easily round it. In this plate are four screws, such as *g g*, which go into holes in the plate *f f*, and thus draw the two plates *f f* and *d d* together, with the plate *e e* between them. Pieces of thin leather are put on each side of *e e;* and thus all escape of water is effectually prevented, with a very moderate compression and friction.

Fig. 121.



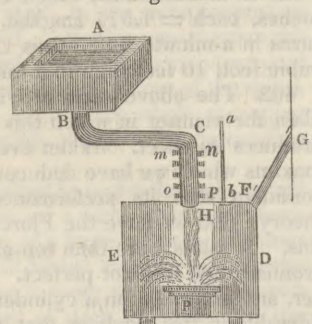
CHAPTER IV. ON MACHINES IN WHICH WATER IS THE CHIEF AGENT.

Sect. I. *On the Water-Blowing Machine.*

Description of the water-blowing machine.

404. The water blowing machine, or *trombe*, as the French call it, consists of a reservoir of water AB, fig. 122, into the bottom of which the bent leaden pipe BCH is inserted; of a condensing vessel DE, into whose top the lower extremity H of the pipe is fixed, and of a pedestal P resting on the bottom of this vessel. When the water from the reservoir AB is descending through the part CH of the pipe, it is in contact with the external air by means of the orifices or tubes *m, n, o, p;* and by the principle of the lateral communication of motion in fluids, the air is dragged along with the water. This combination of air and water issuing from the aperture H, and impinging upon the surface of the stone pedestal P, is dispersed in various directions. The air being thus separated from the water, ascends into the upper part of the vessel, and rushes through the opening F, whence it is conveyed by the pipe FG to the fire at G, while the water falls to the lower part of the vessel, and is discharged by the openings M, N. That the greatest quantity of air may be driven into the vessel DE, the water should begin to fall at C with the least possible velocity; and the height of the lowest tubes above the extremity H of the pipe should be three-elevenths of the length of the vertical tube CH, in order that the air may move in the pipe FG with sufficient velocity.

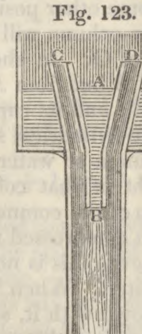
Fig. 122.



Water Blowing Machine.

405. A different form of the machine is shewn in fig. 123, where AB is the pipe of a conical form, and where the water which flows down AB is supplied with air by the pipes CB, DB.

Fig. 123.



406. In the machines of this kind used at Alvar in Dauphiny, the diameter of the conical pipe AB is 12 inches at A, and 5 at B, and only four tubes are used for admitting the air. This machine gives a powerful as well as an equal and continued blast, but the air is considered to be too moist and too cold.

Way whic wind nera

407. Fabri and Dietrich imagined that the wind is produced by the decomposition of the water, or its transformation into gas, in consequence of the agitation and percussion of its parts. But M. Venturi, to whom we owe the first philosophical account of this machine, has shewn that this opinion is erroneous, and that the wind is supplied from the atmosphere, for no wind was generated when the lateral openings *m, n, o, p* were shut. The principal object, therefore, in the construction of water-blowing machines, is to combine as much air as possible with the descending current. For this purpose the water is often made to pass through a kind of cullender placed in the open air, and perforated with a number of small triangular orifices. Through these apertures the water descends in many small streams; and by exposing a greater surface to the amosphere, it carries along with it an immense quantity of air. The water is then conveyed to the pedestal P, fig. 122, by a pipe CH opened and enlarged at C, so as to be considerably wider than the end of the tube which holds the cullender.

408. It has been generally supposed that the waterfall should be very high; but Dr Lewis has shewn, by a variety of experiments, that a fall of four or five feet is sufficient,

B[r]amah's [Pr]ess.

and that when the height is greater than this, two or more blowing machines may be erected, by conducting the water from which the air is extricated, into another reservoir, from which it again descends, and generates air as formerly. In order that the air which is necessarily loaded with moisture, may arrive at the furnace in as dry a state as possible, the condensing vessel DE should be made as high as circumstances will permit; and in order to determine the strength of the blast, it should be furnished with a gage *a b* filled with water.

Ca[us]es of th[e r]ain wi[nd].

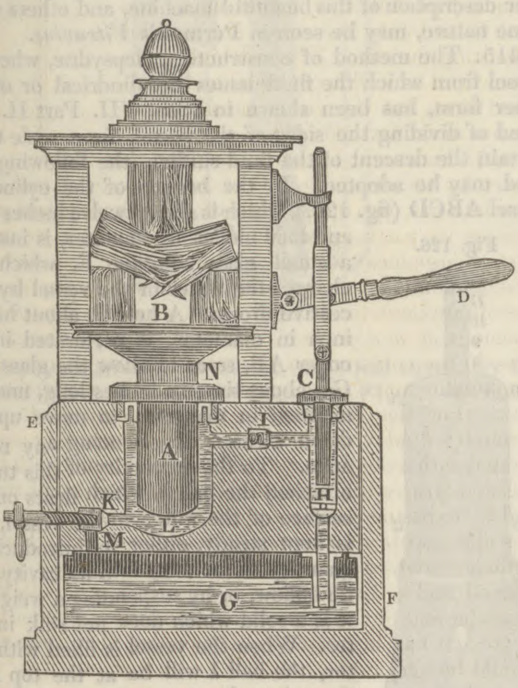
409. The rain wind is produced in the same way as the blast of air in water-blowing machines. When the drops of rain impinge upon the surface of the sea, the air which they drag along with them often produces a heavy squall, which is sufficiently strong to carry away the mast of a ship. The same phenomenon happens at land, when the clouds empty themselves in alternate showers. In this case, the wind proceeds from that quarter of the horizon where the shower is falling. The common method of accounting for the origin of the winds by local rarefaction of the air appears pregnant with insuperable difficulties; and there is reason to think that these agitations in our atmosphere ought rather to be referred to the principle which we have now been considering. The *ventaroli* which issue from volcanic mountains, arise from the air which is carried down the hollows by the falls of water. At the foot of the cascades which fall from the glazier of Roche Melon, Venturi found the force of the wind arising from the air dragged down by the water to be so strong, that it could scarcely be withstood. For farther information on this subject, the reader is referred to Lewis's *Commerce of Arts*, Wolfii *Opera Mathematica*, tom. i. p. 830, *Journal des Mines*, No. XCI. or Nicholson's *Journal*, vol. ii. 4to, p. 487, vol. xii. p. 48.

SECT. II. *Bramah's Hydrostatic Press.*

D[esc]rip-ti[on] of Bra-m[ah']s ma-ch[in]e.

410. The machine invented by Mr Bramah, depends upon the principle, that any pressure exerted upon a fluid mass is propagated equally in every direction. It is represented in fig. 124, where L is a strong metallic cylinder,

Fig. 124.



Bramah's Press.

furnished with a piston A, perfectly water-tight at the neck N. Into the side of this cylinder is inserted the end of the tube I, the interior orifice of which is closed by the valve at I. The other extremity of the tube communicates with the forcing pump DCH, by which water or other fluids may be driven into the cylinder L. The whole rests on a solid mass of masonry EF, or a firmly fixed wooden frame. A valve K, wrought by a screw, allows the water to return to G from the pipe M. The body to be crushed, broken, or pressed, is placed above the horizontal board B. Then, if any pressure is exerted on the surface of the water in the cylinder H, by means of the lever D, this pressure will be propagated to the cylinder L, and exert a certain force upon the piston A, varying with the respective areas of the sections of each cylinder. If the diameter of the cylinder H, is equal to the diameter of the cylinder L, and if a force of 10 pounds is exerted at the handle D, then the piston A will be elevated with a force of 10 pounds; if the diameter of H be one-half that of L, the piston A will be raised with a force of 40 pounds, because the area of the one piston is four times the area of the other. Or, in general, if D be the diameter of the cylinder L, d that of the cylinder H, and F the force exerted at the lever D, we shall have $d^2 : D^2 = F : \frac{F \times D^2}{d^2}$, which is the force exerted upon the piston B. Thus, if $d = 2$ inches, $D = 24$ inches, and $F = 10$ pounds, then $\frac{F \times D^2}{d^2} = \frac{10 \times 24 \times 24}{2 \times 2} = 1440$ pounds, the force with which the piston B is elevated. Now, as this force increases as d^2 diminishes, or as F and D^2 increase, there is no limit to the power of the engine; for the diameter of the cylinder L may be made of any size, and that of the cylinder H exceedingly small, while the power may be still farther augmented by lengthening the lever D. The same effects may be produced by injecting air into the pipe I by means of a large globe fixed at its extremity. Upon the same principles the power and motion of one machine may be communicated to another; for we have only to connect the two machines by means of a pipe filled with water, inserted at each extremity into a cylinder furnished with a piston. By this means the power which depresses one of the pistons will be transferred along the connecting pipe, and will elevate the other piston. In the same way water may be raised out of wells of any depth, and at any distance from the place where the power is applied; but we must refer the reader, for a detailed account of these applications, to the specification of the patent obtained by Mr Bramah, or to *Gregory's Mechanics*, vol. ii. p. 120.

SECT. III. *M. Mannoury Dectot's Dunaide.*

De[c]tot's Danaide.

411. This machine, invented by M. Mannoury Dectot of Paris, consists of a cylindrical trough of tin-plate, nearly as high as it is broad, and having a hole in the centre of its bottom. It is fixed to a vertical axis of iron, which passes through the middle of the hole in the bottom, a vacant space being left all around to permit the water to escape. The axis turns with the trough upon a pivot, and is fixed above to a collar.

A drum of tin-plate, close above and below, is fixed upon the axis of the trough, and placed within the trough, so as to be concentric with it, and to leave only between the outer circumference of the drum and the inner circumference of the trough, an annular space not exceeding $1\frac{1}{2}$ inches. This annular space communicates with a space less than $1\frac{1}{2}$ inches, left between the bottom of the drum and the bottom of the trough, and divided into compartments by diaphragms fixed upon the bottom of the trough, Dectot's Danaide.

and proceeding from the circumference to the central hole in the bottom of the trough.

The water comes from a reservoir above by one or two pipes, and makes its way into this annular space between the trough and drum. The bottom of these pipes corresponds with the level of the water in the trough, and they are directed horizontally, and as tangents to the mean circumference between that of the trough and of the drum. The velocity which the water has acquired by its fall along these pipes, makes the machine move round its axis, and this motion accelerates by degrees, till the velocity of the water in the space between the trough and drum equals that of the water from the reservoir; so that no sensible shock is perceived of the affluent water upon that which is contained in the machine.

This circular motion communicates to the water between the trough and drum a centrifugal force, in consequence of which it presses against the sides of the trough. This centrifugal force acts equally upon the water contained in the compartments at the bottom of the trough, but it acts less and less as this water approaches the centre.

The whole water then is animated by two opposite forces, viz. gravity, and the centrifugal force. The first tends to make the water run out at the hole at the bottom of the trough; the second, to drive the water from that hole.

To these two forces are joined a third, viz. *friction*, which acts here an important and singular part, as it promotes the efficacy of the machine, while in other machines it always diminishes that efficacy. Here, on the contrary, the effect would be nothing were it not for the friction, which acts as a tangent to the sides of the trough and drum.

By the combination of these three forces, there ought to result a more or less rapid flow from the hole at the bottom of the trough; and the less force the water has as it issues out, the more it will have employed in moving the machine, and of course in producing the useful effect for which it is destined.

The moving power is the weight of the water running in, multiplied by the height of the reservoir from which it flows above the bottom of the trough; and the useful effect is the same product diminished by half the force which the water retains when it issues out of the orifice below.

In order to ascertain, by direct experiment, the magnitude of this effect, MM. Prony and Carnot fixed a cord to the axis of the machine, which passing over a pulley, raised a weight by the motion of the machine. By this means, the effect was found to be $\frac{7}{10}$ of the power, and often approached $\frac{75}{100}$ without reckoning the friction of the pulleys, which has nothing to do with the machine. This effect exceeds that of the best overshot-wheels. See the *Report of the Institute,* 23d August 1813; or Thomson's *Annals of Philosophy,* vol. ii. p. 412.

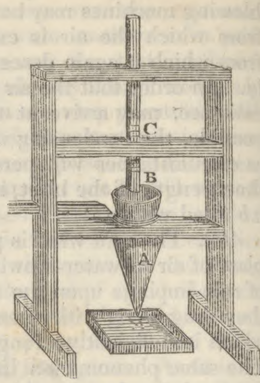
Sect. IV. *On Clepsydræ or Water-Clocks.*

History of clepsydræ.

412. A clepsydra or water-clock, derived from κλέπτω, *to steal,* and ὕδωρ, *water,* is a machine which measures time by the motion of water. The invention of this machine has been ascribed to Scipio Nasica, the cousin of Scipio Africanus, who flourished about two hundred years before the Christian era. It was well known, however, at an earlier period, among the Egyptians, who employed it to measure the course of the sun. It is highly probable that Scipio Nasica had only the merit of introducing it into his native country. These machines were in use for a very long period, and continued to be employed as measurers of time till the invention of the pendulum clock enriched the arts and sciences.

413. The earliest, and probably the simplest water-clock, consisted of a hollow cone A (fig. 125), perforated at its apex, and of a solid cone B, which exactly fitted the interior of A. The aperture of the cone A was of such a size in relation to the contents of A, that it discharged all the water in A in the course of the shortest day in winter. The length of the cone was divided into *twelve* parts, which indicated the hours as the water was discharged. As the day became longer, the line in which the water was discharged required to be increased; and, in order to effect this, the solid cone B was introduced into the hollow cone A, and, in proportion to the depth of its immersion, the water flowed with less facility, and more slowly, from the aperture at the vertex of the cone A. By this means the time of emptying the cone was accommodated to the varying length of the day, and the adjustment for this purpose was made by a graduated scale BC, upon the handle of the solid cone.

Fig 125.



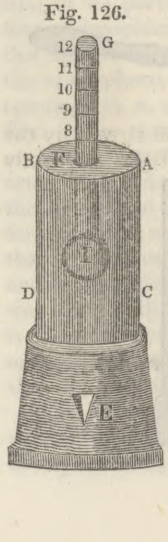
Clepsydr

The clepsydra of Ctesibii

413. The clepsydra, invented by Ctesibius of Alexandria, was an interesting machine. The water, which indicated the progress of time by the gradual descent of its surface, flowed in the form of tears from the eyes of the human figure. Its head was bent down with age: its look was dejected, while it seemed to pay the last tribute of regret to the fleeting moments as they passed. The water which was thus discharged was collected in a vertical reservoir, where it raised another figure, holding in its hand a rod, which, by its gradual ascent, pointed out the hours upon a vertical column. The same fluid was afterwards employed in the interior of the pedestal, as the impelling power of a piece of machinery, which made this column revolve round its axis in a year, so that the months and the days were always shewn by this index, whose extremity described a vertical line divided according to the relative lengths of the hours of day and night. Among the ancients the length of the hours varied every day, and even the hours of the day differed in length from those of the night; for the length of the day, or the interval between sunrise and sunset, was always divided into twelve equal parts, while the length of the night, or the interval between sunset and sunrise, was divided into the same number of parts, for hours. A farther description of this beautiful machine, and others of the same nature, may be seen in Perrault's *Vitruvius.*

415. The method of constructing clepsydræ, when the vessel from which the fluid issues is cylindrical or of any other form, has been shewn in Prop. VII. Part II. Instead of dividing the sides of the vessel, for a scale to ascertain the descent of the fluid surface, the following method may be adopted. In the bottom of the cylindrical vessel ABCD (fig. 126.), which is about twelve inches high, and four inches in diameter, is inserted a small glass adjutage E, which discharges the water in the vessel by successive drops. A hole F, about half an inch in diameter, is perforated in the cover AB, so as to allow the glass tube GI, about sixteen inches long, and half an inch in diameter, to move up and down without experiencing any resistance. To the extremity of this tube is attached the ball I, which floats on the surface of the water in the vessel, and is kept steady, either by introducing a quantity of mercury into its cavity, if it be hollow, or by suspending a weight, if it is a solid which does not sink in water. When the vessel is filled with water, the ball I will be at the top AB; then, in order to graduate the tube C,

Fig. 126.



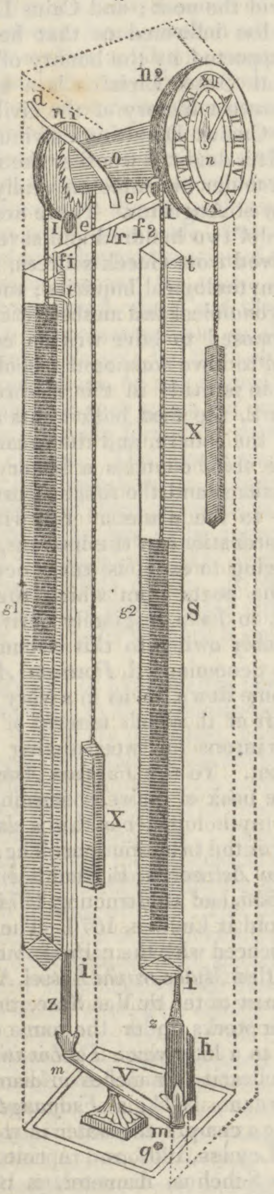
Clepsydræ.

let the water flow out at E, and by means of a watch mark the points on the tube, which descend to F after the lapse of every hour, and every quarter, and the instrument will be finished. In order to use this hydroscope or water-clock, pour into the vessel ABCD till the hour of the day is about to descend below F; and when this is done, it will point out any succeeding hour till the vessel is emptied.

Hamilton's clepsydra.

359. The clepsydra, invented by the honourable Mr Charles Hamilton, is represented in fig. 127. An open

Fig. 127.



canal ee, supplied with a constant and equal stream by the syphon d, has at each end ff, open pipes $f1$, $f2$, of exactly equal bores, which deliver the water that runs along the canal e, alternately into the vessels $g1$, $g2$, in such a quantity as to raise the water from the mouth of the tantalus t, exactly in an hour. The canal ee is equally poised by the two pipes $f1$, $f2$, upon a centre r; the ends of the canal e are raised alternately, as the cups zz are depressed, to which they are connected by the lines running over the pulleys ll. The cups zz are fixed at each end of the balance mm, which moves up and down upon its centre v. $n1$, $n2$, are the edges of two wheels or pulleys, moving different ways alternately, and fitted to the cylinder o by oblique teeth, both in the cavity of the wheel and upon the cylinder, which, when the wheel n moves one way, that is, in the direction of the minute-hand, meet the teeth of the cylinder, and carry the cylinder along with it, and slip over those of the cylinder when n moves the contrary way, the teeth not meeting, but receding from each other. One or other of these wheels nn continually moves o in the same direction, with an equable and uninterrupted motion. A fine chain goes twice round each wheel, having at one end a weight X, always out of the water, which equiponderates with y at the other end, when kept floating on the surface of the fluid in the vessel g, which y must always be; the two cups z, z, one at each end of the balance, keep it in equilibrio, till one of them is forced down by the weight and impulse of the water, which it receives from the tantalus ti. Each of these cups z, z, has likewise a tantalus of its own h, h, which empties it after the water has run from g, and leaves the two cups again in equilibrio: q is a drain to carry off the water. The dial-plate, &c. needs no description. The motion of the clepsydra is effected thus: As the end of the canal ee, fixed to the pipe $f1$, viz. the lowest in the figure, all the water supplied by the syphon runs through the pipe $f1$, into the vessel $g1$, till it runs over the top of the tantalus t; when it immediately runs out at i, into the cup Z, at the end of the balance m, and forces it down; the balance moving on its centre V. When one side of m is brought down, the string which connects it to $f1$, running over the pulley l, raises the end $f1$, of the canal e, which turns upon its centre r, higher than $f2$; consequently, all the water which runs through the syphon d, passes through $f2$ into $g2$, till the same operation is performed in that vessel, and so on alternately. As the height to which the water rises in g in an hour, viz. from S to t, is equal to the circumference of n, the float y rising through that height along with the water, allows the weight X to act upon the pulley n, which carries with it the cylinder o; and this, making a revolution, causes the index k to describe an hour on the dial-plate. This revolution is performed by the pulley $n1$; the next is performed by $n2$, whilst $n1$ goes back, as the water in $g1$ runs out through the tantalus; for y must follow the water, as its weight increases out of it. The axis o always keeps moving the same way; the index p describes the minutes; each tantalus must be wider than the syphon, that the vessels gg may be emptied as low as S, before the water returns to them.

360. For farther information respecting subjects connected with hydrodynamics, see MECHANICS, RESISTANCE *of Fluids*, WATER-*Works*, &c. (N. N. N.)

HYDROGRAPHICAL CHARTS or MAPS, usually called sea-charts, are projections of some part of the sea or coast, for the use of navigation. In these are laid down all the rhumbs or points of the compass, the meridians, parallels, &c. with the coasts, capes, islands, rocks, shoals, shallows, &c. in their proper places and proportions.

HYDROGRAPHY, the art of measuring and describing the sea, rivers, canals, lakes, and the like. With regard to the sea, it gives an account of its tides, countertides, soundings, bays, gulfs, creeks, as also of the rocks, shelves, sands, shallows, promontories, and harbours; the distance and bearing of one port from another; with every thing that is remarkable, whether out at sea or on the coast.

HYDROMEL, honey diluted in nearly an equal weight of water. When this liquor has not fermented, it is called *simple hydromel;* and when it has undergone the spirituous fermentation, it is called the *vinous hydromel* or *mead.*

HYDROMETER, an instrument for measuring the gravity, density, &c. of water and other fluids. For an account of different hydrometers, see the article HYDRODYNAMICS.

HYDROPHANES, or OCULUS MUNDI, a kind of precious stone, which becomes transparent in water. It was much esteemed by the ancients.

HYDROPHOBIA, literally an aversion to or dread of water, a terrible symptom of the *rabies canina,* and which has likewise been found to take place in violent inflammations of the stomach, as well as in hysterical fits.

HYDROPHYLACIA, a word used by Kircher and some others to express those great reservoirs of water which, as he supposed, were placed in the Alps and other mountains for the supply of the rivers which run through the lower countries. The formation of these reservoirs he considers as one of the great uses of mountains in the economy of the universe.

HYDROSCOPE, an instrument anciently used for measuring time. The hydroscope was a kind of water-clock, consisting of a cylindrical tube, conical at the bottom. The cylinder was graduated, or marked with divisions, to which the top of the water becoming successively continuous, as it trickled out at the vertex of the cone, indicated the hour.

HYDROSTATICS is that branch of physics which treats of the weight, pressure, and equilibrium of fluids. See HYDRODYNAMICS.

HYDROTHORAX, a collection of water in the chest.

HYDRUNTUM, in *Ancient Geography,* a noble and commodious port of Calabria, from which there was a shorter passage to Apollonia. It was famous for its antiquity, and for the fidelity and bravery of its inhabitants. It is now Otranto, a city of Naples, situated at the entrance of the Gulf of Venice. Long. 19. 15. E. Lat. 40. 12. N.

HYEMANTES, in the primitive church, were offenders who had been guilty of so great enormities, that they were not allowed to enter the porch of the churches with the other penitents, but were obliged to stand without, exposed to all the inclemency of the weather.

HYGEIA, in *Mythology.* See HEALTH.

HYGIEINE, Ὑγιεινη, formed from ὑγιης, *sound* or *healthy,* that branch of medicine which relates to health, and discovers proper means for the preservation of that state.

HYGIEINE, more largely taken, is divided into three parts: *prophylactice,* which foresees and prevents diseases; *synteritice,* which is employed in preserving health; and *analeptice,* which relates to the cure of diseases, and the restoration of health.

HYGINUS, CAIUS JULIUS, an ancient Latin writer, who flourished in the time of Augustus. Suetonius, in his work *De Illustribus Grammaticis,* says that he was by birth a Spaniard; but some think that he was a native of Alexandria in Egypt. He was originally a slave of Julius Cæsar, who brought him to Rome; but having distinguished himself by his literary acquirements, he was emancipated by Augustus, and placed at the head of the library which that sovereign had founded in the temple of the Palatine Apollo. Whilst in this situation, he became intimate with Ovid the poet; and Caius Licinius, a man of consular rank, has informed us that he died very poor, having been supported by the bounty of his friends; but some think that Caius Licinius is a mistake for Caius Asinius, who wrote a history of the civil war, and served as consul with Cneius Domitius Calvinus, in the year of the city 723. It is doubtful whether the works which have been preserved under his name are really the productions of the freedman of Augustus. These are *Fabularum Liber,* a collection of two hundred and seventy-seven fables, principally derived from Greek sources, and which are of great value in mythological inquiries; and *Poeticon Astronomicon,* an astronomical and mathematical work in prose. He is also supposed to have written on the subject of agriculture, and to have composed a book of Genealogies, of which mention is made in the *Poeticon Astronomicon.* Of this last work, the first book treats of the world and the doctrine of the sphere, and the second of the signs in the zodiac; the third contains a history and description of the constellations, and the fourth treats of the several things relating to the planets. But whilst Hyginus describes the constellations in the heavens, and enumerates the stars belonging to each, he takes occasion to explain the fables of the poets from which these constellations were supposed to have originally derived their names, and it is probably owing to this circumstance that the work has been denominated *Poeticon Astronomicon.* It has however come down to us in a very imperfect state; and all that part of it which treated of the month, the year, and the reasons for intercalating the months, has been entirely lost. To the *Poeticon Astronomicon* is usually appended a book of fables, containing a compendium of the heathen mythology; but this is also imperfect, and is moreover suspected to be spurious. The *Liber Fabularum* and the *Poeticon Astronomicon* have been published together at Basle, 1555, and at Hamburg, 1674; and separately at Paris, 1578, and at Leyden, 1670. The best editions are those which appeared with the commentary of Muncker, in a collection entitled *Mythographi Latini,* Amsterdam, 1681, reprinted with new notes by Van Staveren, Leyden, 1763. There are other works under the name of Hyginus, but they all belong to a later age: *De Limitibus constituendis,* published in a collection entitled *Rei Agrariæ Auctores, cura Goesii,* Amsterdam, 1674; a *Fragment* on the proper mode of pitching a camp, published first by Scriverius, along with Vegetius, Leyden, 1607, and reprinted with a learned commentary by Schelius, Amsterdam, 1661, and also by Grævius in his *Thesaurus.* Angelo Maio, the learned librarian of the Vatican, has added three new works on mythology to those which we already possessed, and one of these is under the name of Hyginus, but evidently by a writer of the fifth century. Other manuscripts of the same works have since been discovered at Göttingen, Gothe, and Paris; and Dr Bode has published a new edition, with a careful collation of these manuscripts, *Scriptores Rerum Mythicarum Latini tres Romæ nuper reperti,* Celle, 1834. For the life of Hyginus, freedman of Augustus, consult Scheffer, *De Hygini Script. Fabul. ætate atque stylo;* and Muncker, *De auctore, stylo, et ætate Mythologiæ quæ C. Hygini nomen præfert.*

HYGROMETRY.

Hygrometry. The formation of steam or aqueous vapour, and its diffusion in space or in a gaseous medium, have already been considered under the article EVAPORATION. We now propose first to take a view of various methods and devices which have been employed to detect the presence of aqueous vapour, and to ascertain its amount, or how much of it is contained in a given volume, whether when alone or diffused in a gaseous medium. This is necessarily connected with, and will in a great measure consist of, the description, theory, and use of such instruments as almost exclusively belong to this branch of inquiry, and which are usually denominated *hygrometers*, from ὑγρος, *moist*, and μετρεω, *I measure.* We shall then consider under what circumstances moisture is deposited from the atmosphere, and shall examine some of the more remarkable phenomena resulting from or connected with the condensation of aqueous vapour.

Two classes of hygrometers. Many contrivances bearing the name of hygrometers have appeared from time to time, and these, though extremely various in their constructions, we shall only divide into two very different classes: 1*st*, Such as are slow or uncertain in their indications, or are formed of decaying or changing materials; 2*d*, such as are not only more prompt in their indications, but are formed of materials comparatively free from change. The former are obviously unfit for hygrometers, but have been so numerous, that a description of the whole of them alone would greatly exceed our limits; which is the less to be regretted, since the greater and more superficial part have already served their day, and gone entirely into disuse. It will, however, be proper briefly to notice a few of those either already become obsolete, or soon to be so, were it only to show their imperfection.

Uncertain and changing class. The earliest account of hygrometers perhaps worth noticing is that contained in the *Philosophical Transactions* for 1676, where several are described, and allusions made to others; but both then, and during more than a century which followed, the indications of such instruments depended on the change which the weights or dimensions of bodies undergo from a change of humidity. Thus, when the weather becomes more damp, the deliquescent salts gradually become heavier from absorbing moisture, and in drier weather lighter from parting with it. The like happens with certain stones and various other minerals; with sulphuric acid and several other liquids; with sponges and many vegetable and animal substances, whose dimensions are considerably though slowly altered by change of humidity. In bodies of a fibrous structure, however, the change of dimension occurs principally in a transverse direction, or across the fibres, and but very slightly in the direction of their length. Thus a beam of straight-grained wood becomes thicker and broader by absorbing moisture, and *vice versa;* while its length is altered in a much smaller râtio. The same thing takes place with whalebone, ivory, and other substances.

Wooden hygrometer. As several sorts of wood are at first very susceptible of participating in the dryness and moisture of the atmosphere, they have sometimes been employed in the construction of hygrometers. For this purpose a small and very thin board is placed on edge, with its ends slightly entering into grooves in two upright pillars, its fibres being in a horizontal direction, so that the expansion or contraction of the board may be vertical; for, as was noticed above, it is principally in the lateral direction, or across the fibres, that wood expands or contracts by change of humidity. On the upper edge of the board is fixed an upright toothed rack, working in the leaves of a small pinion, on whose axis is fixed a wheel, which turns another pinion on the axis of the index. It is thus evident, that a very slight motion communicated to the rack, by the rising or falling of the upper edge of the board, will be greatly magnified by the wheel-work, so as to be shown in a very sensible manner by the index. But the defect of this and all similar contrivances is, that the wood takes such a long while to receive the impressions, whether of humidity or dryness, from the atmosphere, that by the time they indicate greater dampness, the air may have really become drier, and *vice versa;* and besides, the board gradually becomes less sensible to these impressions, till at length the index almost ceases to move.

An obvious consequence of the lateral expansion and contraction of organic fibres is, that ropes, cords, or strings, formed of such fibres twisted together, are rendered thicker and shorter by absorbing moisture, and *vice versa.* On this principle it has frequently been attempted to construct hygrometers, as, for instance, by making fast one end of a piece of rope, cord, or catgut, winding it backwards and forwards over several pulleys, and suspending from its other end a small weight, which, by rising and falling with the alternate shortening and lengthening of the cord, marks, on a graduated scale placed behind it, the changes of humidity. Sometimes the one extremity of the catgut being made fast, the other carries a small weight, and an intermediate part is wound on a small axis, carrying an index round a graduated plate, the degrees of which are meant to mark the humidity or dryness of the air. When a weight is suspended by a fine string, a piece of catgut, or the naturally twisted beard of the wild oat, it will be seen to turn in the one direction or the other, owing to the twisting and untwisting of the cord, from the changes of humidity. The hygrometer or weather-house, commonly sold as a toy, depends on this principle. It usually consists of a kind of box, representing a building with two doors, within which is suspended a horizontal bar, by means of a cord attached to its middle. Upon one end of this bar is a figure of a man, with an umbrella to protect him from the rain, and on the other that of a woman with a fan. They are so adjusted in respect of the doors, that when the man appears it is a sign of rain; but when he withdraws, and the woman presents herself, fair weather is predicted. This contrivance unfortunately has just the same faults as the one first noticed, being both liable to change and decay, so as ultimately to lose almost entirely its sensibility. It is therefore of no other use than as a mere toy; for the value of an instrument employed as a measure of any kind must depend not only on its being at first accurately constructed, but likewise upon its indications not being, *cæteris paribus*, liable to change.

Effects of changes of humidity on cabinet work. The preceding remarks upon the effects of a change of humidity on organic substances may enable us to correct what we consider a great mistake. Slips of metal are sometimes employed to strengthen or bind together cabinet work; and this has been objected to on the professedly scientific ground, that the expansion and contraction of the metal by change of temperature is apt to tear, warp, or distort the wooden work. That some such effects as have just been stated do frequently occur, cannot be denied; but we have no hesitation in ascribing them to a very different and far more powerful cause, the lateral expansion and contraction of the wood itself by changes of humidity, and particularly the permanent contraction due to the gradual loss of natural sap, if the wood has not been

Hygrometry.

previously well seasoned; for the bad effects in question rarely appear at first, and only occur at all when the metal is of considerable length and fixed across the grain of the wood, and more especially when the wood has not been of the proper sort, or has been worked when damp or badly seasoned. Indeed, when a sufficiently strong slip of wood is firmly applied in place of and in the same position as the metal, there is, *cæteris paribus*, no sensible difference in the bad effects; and it is particularly to be remembered, that a rise of temperature which would alter the length of the metal so as to do any harm in the manner supposed, would seriously injure cabinet work although no metal were near it. Wood in general, if exposed to drought, continues to shrink permanently more or less, especially in the lateral direction, or across the fibres, so long as it lasts; and when alternately exposed to the expanding and contracting influences of moisture and drought, the permanent contraction is upon the whole accelerated and increased.

Kater's hygrometer.

The hygrometer invented by the late ingenious Captain Kater depends upon the twining and untwining which the changes of humidity produce in the naturally twisted beard of grass known in the *Canarese* language by the name of *Oobeena Hooloo.* This is the *Andropogon contortum* of Linnæus, and is gathered in the Mysore country in January. The frame of this instrument is commonly cylindrical; and, that it may allow the air to pass freely through, it is formed of small bars of brass, or sometimes of silver. Upon one end of this frame is soldered a flat plate, having a projecting rim, to protect the index which turns upon it over a circular dial divided into a hundred equal parts or degrees. The index, which is very slender and nicely balanced, is put on one end of an axis of silver wire, which has liberty both to turn round and to shift a little longitudinally through double conical holes in the frame. The axis extends about half the length of the frame; and a part of it next the index is formed into a screw of fourteen or fifteen threads. This is effected by twisting tightly round it a smaller silver wire. A loop and drop made of fine gold wire are so formed, that when suspended from the axis, the loop may slide freely along the screw, and by the number of threads thus run over, it can show the number of complete revolutions of the index. The farther end of the axis is swelled a little, and has a notch to receive the end of the *Oobeena Hooloo*, which is fixed by drawing upon it a sliding ring. This beard is then extended in the line of the continuation of the axis, till it meet the frame, where its other end is fixed similarly to the former one, but admits of adjustment by a screw which stretches it slightly. Such is a brief outline of the very simple and ingenious mechanism by which the gradual expansion or contraction of the hygrometric substance communicates a rotatory motion to the index; so that whilst the index shows the fraction of a revolution on the graduated dial, the loop and drop indicate the number of complete revolutions, or the integral number of hundreds of degrees which the index has passed over on the dial. So great is the sensibility of this instrument, that its index makes ten or twelve revolutions, while that of Saussure's only makes one. Captain Kater recommended that all observations made with his hygrometer should be reduced to what they would have been had the entire scale, or the utmost range traversed by the index, consisted of a thousand degrees, which would be ten complete revolutions. By this, we suppose, he meant to render all hygrometers of his construction comparable; a property which, however, belongs to no hygrometers whose principal parts are formed of animal or vegetable substances, which are continually changing, and gradually becoming less and less sensible to the influence of humidity.

Balance hygrometer.

Hygrometers have frequently been formed by suspending from one arm of a balance some substance which strongly attracts moisture from the atmosphere, and nicely counterpoising it by a weight on the other arm. The changes in the humidity of the air are then meant to be indicated by the changes in the position of the beam, arising from the gain or loss of weight in the suspended body. A great variety of substances have been used for this purpose, such as sponge, caustic potash, the deliquescent salts, sulphuric acid, &c. These, like the former instruments, are all too late in their indications, though some of them might scarcely be liable to lose their sensibility, were it not that they soon become useless from the accumulation of dust, soot, &c. especially if in or near a large city.

But the expansions and contractions of hair and of whalebone are, from the tenuity of their substance, somewhat more expeditious in acquiring the humidity or dryness of the surrounding air. They have therefore been employed in the construction of hygrometers; the former by Saussure, and the latter by Deluc. Both these instruments are impaired by time, and they sometimes acquire contrary errors. Their indications generally differ materially, even when graduated alike, and more especially when differently graduated; but so unsteady is the relation between them, even for the same state of the air, that no certain rule can be given for reducing the one to the other. This is evident from the circumstance, that scarcely two authors who do not derive their information from the same source agree respecting the relation between the indications of these instruments. Deluc states, we think, very just objections to Saussure's hygrometer, and as justly does Saussure object to his; so that, had it not been out of respect for the high reputation of these philosophers, and the frequent reference made to their instruments in scientific researches, and in books of voyages and travels, we should scarcely have felt warranted to give even the following brief description of them here. We begin with that of Saussure, which is represented in fig. 3, Plate CCXCV.

Saussure's hygrometer.

The lower end of the hair *ab* is held by the screw-pincers *b* at the bottom of the frame. These pincers, shown separately at B, fig. 4, terminate in a screw which enters the hollow screw C, fig. 5. By turning this screw, the pincers *b* or B may be raised or lowered at pleasure. The other end *a* of the hair is held by the inferior mouth of the double and moveable pincers *a*, seen separately at A, fig. 6, and which, with their upper mouth, take hold of a fine well-tempered silver wire, which is wound round the arbor *d*. This arbor, seen separately at DF, fig. 6, carries the index *ee*, marked E in the separate figure 6, and is cut like a screw, with a flat-bottomed groove to receive the silver wire, which, as mentioned above, is connected with the hair by means of the double pincers. The wire was adopted from its being found that, when the hair itself was wound on the arbor, it became rough, and contracted a stiffness, which the small weight *g* or G, employed as a counterpoise, could not overcome; whereas a proper wire always preserves the same flexibility. It was necessary thus to cut the arbor like a screw, that the wire might not have its coils wound one upon another, so as to thicken the arbor, or to take a position too oblique and uncertain. The wire is fixed to the arbor by a small pin F. The other end D of the arbor has the form of a pulley, with a groove flat at the bottom to receive a fine silk thread, by which is suspended the counterpoise marked *g* in fig. 3, and G in fig. 6. This is intended to keep the hair always gently stretched. One end of the arbor, formed into a fine pivot, passes through the centre of the dial, and carries the index *ee* on its extremity. The other end has a similar pivot turning in the arm *h* of the doubly-kneed piece *hi*, or HI, fig. 7, which is fixed to the back of the dial *kk* by the screw I. The dial is divided into 360 degrees, and is soldered to two tubes *ll*, which surround and can be slid up and down the two upright wires *mm, mm* of the frame. The dial can thus be fixed at any place on the wires by means of the screws *nn*. The square column *pp* carries a box *q*, to which is fixed a sort of pencil-case *r*, fitted to receive the counterpoise *g*. When the hygrometer is to be transported to another place, and some harm is apprehended from the vibrations of the counterpoise, the case *r* is raised to receive it. Both are then made fast by the screws *s* and *t*. When, again, the hygrometer is to be used, the counterpoise is disengaged, and the box lowered as in the figure. At the corners of the base of the frame are four screws *o, o, o, o*, for the purpose of levelling the base, or making the instrument stand upright. The three columns of the frame are connected at the top by the crooked piece *xyx*, having a hole at *y*, by which the instrument may be suspended.

The point of extreme dryness is obtained by placing the instrument under a receiver, with a quantity of quicklime or caustic alkali; and that of extreme moisture by enclosing it in a receiver whose sides are kept continually moistened. This last Deluc regards as very fallacious.

The scale of Saussure's hygrometer sometimes contains 100 divisions or degrees, and sometimes a larger number. That in our figure has 360. Saussure gives a decided preference to human hair, which he first causes to undergo a preparation, for the purpose of divesting it of a kind of natural oiliness, which, if not removed, would render it less sensible to the action of humidity. This preparation is made at the same time on a considerable number of hairs forming a tuft, the thickness of which need not exceed that of a quill. This tuft being enveloped in a bit of fine cloth, as in a case, is immersed in a long-necked phial full of water, holding in solution about the hundredth part of its weight of sulphate of soda, and which is made to boil about three minutes. The tuft is then passed through two vessels of pure water at the boiling temperature; afterwards the hairs are drawn from their wrapper and separated; then they are hung up to dry. It only remains to select those which are cleanest, softest, most brilliant, and most transparent. The effects of dryness and of moisture upon the hair are modified by those of heat, which affect it in different ways. Thus, if it be supposed, for example, that the air becomes warmer about the hygrometer, its drying quality being thereby increased, it will abstract from the hair a part of the water which it had imbibed, thus tending to shorten it; while, on the other hand, the heat, by expanding the hair, will tend, though in a much smaller degree, to lengthen it; so that the total effect will consist of the excess of the former over the latter. It is therefore necessary, where precision is aimed at, to consult the thermometer, and apply a corresponding correction.

Properties of perfect hygrometer.

In his *Essais sur l'Hygrométrie*, M. de Saussure, while he candidly acknowledges the imperfection of his own instrument, enumerates the following as properties which he thinks a perfect hygrometer ought to possess: 1*st*, Its variations should be sufficiently extensive to show very small changes of humidity or dryness; 2*d*, these indications should be so prompt as to proceed *pari passu* with the actual state of the air; 3*d*, the instrument should always accord with itself; that is to say, in the same state of the air it should always be found at the same degree; 4*th*, it should be comparable; that is to say, any number of hygrometers constructed separately upon the same principles should always indicate the same degree in the same circumstances; 5*th*, it should only be affected by humidity or dryness properly so called; 6*th*, the variations in the indications should be proportional to those of the air; so that, in like circumstances, a double or triple number of degrees should always indicate a double or triple quantity of moisture.

This last property, however, we cannot regard as by any means indispensable to a perfect hygrometer, though we grant that an instrument possessing it is likely to be somewhat more convenient. For it is quite clear, that if we only knew the true relation between the indications of the instrument and the state of the air, we could by that means compute the degree of humidity with perfect certainty; no matter how much the variations of the indications of the instrument and those of humidity differed from simple proportionality.

Deluc's hygrometer.

We shall next give a brief description of Deluc's hygrometer. The frame will be readily understood from inspecting fig. 1, Plate CCXCV. The principal part consists of a slip of whalebone, cut transversely, or across the fibres, and is represented by *ab*. Its end *a* is held by a very simple sort of pincers, made of a bit of flattened wire bent and pressed together on the whalebone by a sliding ring. The other end *b* is fixed to a bar *c*, which can be moved by a screw for adjusting the index *e*, to have a proper position at first on the dial. The loop of the pincers which hold the whalebone is hooked to the end of a thin brass wire, to the other end of which is also hooked a very thin silver gilt lamina, which has at that extremity pincers similar to those of the whalebone; but its other extremity is pinned into a hole in the axis. The spring *d* which stretches the whalebone is made of silver gilt wire; it exerts a force equal to a weight of twelve grains, but with this among other advantages over a weight, that in proportion as the slip is weakened by lengthening, the spring relaxes its force by unbending. The axis has very small pivots, whose ends are confined, to prevent the shoulders from rubbing against the frame. A section of this axis is shown on a large scale in fig. 2. The slip acts on the diameter *aa*, and the spring on the smaller diameter *bb*. The point of extreme dryness is obtained by enclosing the instrument under a receiver, along with some quicklime; that of extreme humidity, by wetting the whalebone with water, or immersing the whole instrument in it. The graduated arc on the dial is about five sixths of the entire circle, and is divided into 100 equal parts or degrees. The zero denotes extreme dryness, and the 100th degree extreme humidity. Saussure, however, alleges that the whalebone is more thoroughly soaked or swelled by immersion in water than in the most humid air, which, he says, never brings it to the extremity of the scale.

Deluc maintains that hairs and other animal or vegetable hygroscopic substances taken lengthwise, or in the direction of their fibres, undergo contrary changes from different variations of humidity; that when immersed in water, they lengthen first, and then shorten; that when they are near the extreme of humidity, they shorten with an increase and lengthen with a diminution of humidity. This he regards as the necessary consequence of their organic reticular structure; and in illustration of it he has given the following comparison between the corresponding indications of his own hygrometer and those of Saussure. The scale of each is supposed to be divided into 100 degrees.

Deluc.	Saussure.	Deluc.	Saussure.
5	15·6	55	88·8
10	29·4	60	91·6
15	40·9	65	93·8
20	50·5	70	95·6
25	59·2	75	97·2
30	68·8	80	98·0
35	73·0	85	100
40	78·3	90	100
45	82·1	95	99·3
50	86·1	100	98·3

 P

From this it would appear, that after the hair becomes very moist, its lateral expansion produces a contraction in the length, as in the case of ropes. Saussure, however, alleges that in this trial his instrument must have been in bad order; and he even retaliates by ascribing as great defects to that of Deluc. According to Boeckman, 10, 20, 30, 40, 45 of Deluc correspond to 33, 54, 65, 80, 86 respectively of Saussure; but in atmospherical observations he found Deluc's at 56 and 48, when Saussure's indicated 85 and 90 respectively.

M. Gay-Lussac has made many experiments on the hair hygrometer, which would place it in a rather more favourable light than the above; and M. Biot has exerted his great analytical skill in endeavouring to perfect its theory, by giving, in his *Traité de Physique* (tome ii. p. 199), a very elaborate investigation of the relation between its indications and the actual humidity, which has been farther illustrated at great length by Signor Melloni, in the *Annales de Chimie et de Physique* for January 1830. But unfortunately this relation is so soon deranged by the rapidly changing and perishable nature of the instrument, as to render all such labours of very little use, no matter how much learning or ingenuity may have been expended on them.

It will be unnecessary here to notice Deluc's ivory hygrometer, because a description of an improved instrument of the same kind will be found under the article METEOROLOGY.

Wilson's hygrometer.

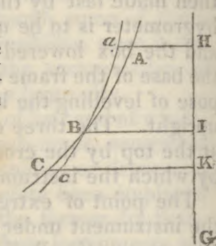
Mr Wilson's hygrometer is very similar to a mercurial thermometer; but in place of the bulb being of glass, it consists of a rat's bladder, which when new is very sensible to changes of humidity; so that by expanding with moisture, or contracting with drought, it produces corresponding depressions, or rises in the column of mercury in the glass stem. This instrument must obviously have its indications somewhat affected by changes of temperature like a thermometer; and, in addition to some of the imperfections common to the instruments already described, it has been objected that the pressure of the column of mercury in the stem must occasion a variable, and perhaps increasing distension of the bladder.

Relations of air to heat.

The foregoing we presume to be sufficient specimens of such hygrometers as are slow or uncertain in their indications, or formed of comparatively changing and perishable materials. These, too, we should think, have been treated at as great length as the little and decreasing importance now attached to them seems to warrant. But since the science of heat lies at the foundation of all accurate knowledge in hygrometry, we now propose, preparatory to entering on the consideration of such hygrometers as are more durable in their construction and constant in their indications, to investigate some relations of air to heat, which will be useful in the sequel of this article. In so doing we shall reason from admitted principles only; for we see no necessity for calling in the aid of the old notion which some are so anxious to revive again, that heat is a species of motion; because such a hypothesis, in place of solving the difficulties, is, like "the occult qualities," a mere subterfuge for our ignorance, or an excuse for not encountering the difficulties, and unavoidably leads to still greater difficulties; whereas the more closely the other theory is traced, the more the difficulties, numerous as they still are, disappear. Of this we shall have occasion to notice several instances in the course of this research. We now begin the investigation with a brief demonstration of the following preliminary proposition.

Lemma.—If the area of a curve between every two ordinates be such that, when cut by a third ordinate in a given ratio, the two corresponding differences in the logarithms of the three abscissæ are likewise in that ratio, the curve is a hyperbola.

Let the curve ABC be such, that when AHKC, its area between any two ordinates AH, CK, is cut by any third ordinate BI, making area AHKC to AHIB in the given ratio of m to n, the three corresponding abscissæ reckoned on the straight line GH from a fixed point G, are related thus; log. GK — log. GH : log. GI — log. GH : : m : n, the curve ABC is a hyperbola.



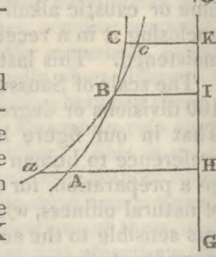
For if not, with G as a centre, GH as one asymptote and the other parallel to AH, describe through B the hyperbola aBc cutting AH and CK in a and c. Then by the well-known property of the hyperbola,

area $aHKc$: $aHIB$: : log. GK — log. GH : log. GI — log. GH.

But AHKC : AHIB : : log. GK — log. GH : log. GI — log. GH;

wherefore, by equality of ratios, alternation and division,

BIKC : BIKc : : AHIB : aHIB.



If cK $<$ CK, and aH $>$ AH, and if the curves do not again meet between A and C, the first term of the analogy last stated must exceed the second, while yet the third is less than the fourth, which is absurd. The like would as readily follow, were cK $>$ CK and aH $<$ AH.

But it is evident that in every case in which the hyperbola is supposed to cut the other curve, the same process of reasoning will lead to the like absurdity, if three ordinates intercepting areas in the given ratio be drawn so close together as to embrace no other meeting of the curves but the foresaid intersection. Now such a construction is always practicable; for in every case two of three such ordinates may be drawn arbitrarily, viz. one through the point of intersection, and a second as close as we please to either side of it; whilst the abscissa which gives the position of a third still nearer, if wished, on the other side, may be had from such an analogy as was stated above, namely,

log. GK — log. GH : log. GI — log. GH : : m : n.

It is indeed a supposable case, that the hyperbola, in place of cutting, might have the other curve wholly on one side, only touching it in the point B; but then it is evident that another hyperbola drawn near enough to that side of the former one, and having the same asymptotes, could not fail to cut the curve ABC. Of course, three ordinates being drawn as before, viz. one through the point of intersection, and the other two near enough to it, would still produce the former absurdity. Hence the curve ABC can only be a hyperbola.

The physical principles which we are about to employ as data for investigating the relations of air to heat, are essentially the same as those from which MM. de Laplace and Poisson attempted to deduce the true scale of the air-thermometer, as may be seen in the *Mécanique Céleste* (tome v. p. 127), and *Annales de Chimie et de Physique* (tome xxiii. p. 337); where, after proceeding so far, and with data which, if properly managed, were amply sufficient for their purpose, they abandoned the project, and contented themselves with *assuming* that the common mode of graduating an air-thermometer forms a true scale of temperature. This they were forced to do in consequence of having adopted a mode of investigation so unnecessarily abstruse that it soon became quite unmanageable. That they should have failed to *prove* the common scale to be the true one, need excite no surprise; for we shall soon see that such a result would be quite incompatible with the very principles from which they attempted to deduce it, and that, without the aid of any assumption, a much more simple process of reasoning, illustrated by a diagram or two, would have necessarily led them to the legitimate, though a very different, result. These principles or data, and some inferences from them, we shall now distinctly state, numbering a few of the paragraphs as we proceed, chiefly for the sake of after reference, and not as if we were specifying so many independent data: for the whole force of the reasoning rests on the first two; the third is merely an inference from the second; and the only use here made of the fourth and fifth is to trace more readily, in known terms, the relation between the common scale of the air-thermometer and the results to which this investigation leads.

1. The law of Boyle and Mariotte, that at the same temperature the elasticity or pressure of air is as its density, or inversely as its volume; and consequently, while air undergoes the same change of temperature, its volume varies under a constant pressure, precisely in the same proportion as the pressure would do were the air confined in an inextensible vessel.

2. If s denote the specific heat of air when it sustains a constant pressure, and s' the specific heat of the same mass of air when confined in an inextensible vessel; then it has been ascertained, through a great range of temperature and pressure, as will be afterwards explained, that s always exceeds s' in a constant ratio, which we may now call the ratio of m to n, which are constants; but their values not being now given, will show our investigation to be independent of the value of their ratio.

These two, viz. the law of Boyle and the *constancy* in the ratio of m to n, are the principles to which we have alluded above as being employed by MM. de Laplace and Poisson, and as being quite sufficient, if properly managed, to have unavoidably led these great mathematicians to the conclusion that air expands in geometrical progression for equal increments of heat. But this, and most of the other legitimate results, they failed to reach, in consequence of unnecessary intricacy, and their introducing an assumption which we shall shortly see to be quite incompatible with the data now specified. The second principle, as will be afterwards noticed more particularly, was first shown by the illustrious M. de Laplace himself to be a necessary deduction from the fact ascertained by the experiments of MM. Desormes and Clement, and more especially by those of MM. Gay-Lussac and Welter, which were continued through a great range of temperature and pressure, viz. that when the density of air suffers a minute and sudden change, m times such variation of density is to the whole density as n times the accompanying variation of pressure to the whole pressure. Or, ϱ being the density and p the pressure,

$$m d\varrho : \varrho :: n dp : p \text{ ; and } \frac{n dp}{p} = \frac{m d\varrho}{\varrho}.$$

3. The last equation evidently expresses the relation between the fluxions of the logarithms of the pressure and density of air when the total heat in it is constant. The fluent is $n \log. p = m \log. \varrho + C$; so that if p' and ϱ' be put for the initial values of p and ϱ, we have $C = n \log. p' - m \log. \varrho'$, and

$$n \log. \frac{p}{p'} = m \log. \frac{\varrho}{\varrho'} \text{ ; or } \left(\frac{p}{p'}\right)^n = \left(\frac{\varrho}{\varrho'}\right)^m,$$

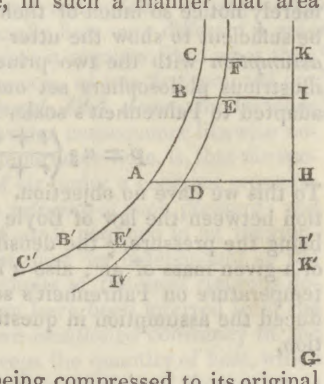
which is the relation between the pressure and density of air, when the total heat in it is invariable.

4. It has been ascertained by Dr Dalton, M. Gay-Lussac, &c. that on heating air under a constant pressure from 32° F. to 212°, its bulk acquires an increase of three eighths. Such increase, in the common graduation of the air-thermometer, is divided into 180 equal parts or degrees for Fahrenheit's scale; and the like divisions corresponding to equal variations of bulk, are continued both above 212° and below 32°, viz. upward indefinitely, but downward they have a limit; for as three eighths are to 180°, so is the whole bulk at the freezing point to 480°; and therefore more than 480 degrees cannot with propriety be reckoned or put below 32° on the Fahrenheit scale of an air-thermometer.

5. Since the freezing point is marked 32°, it is obvious that 480 degrees will reach from it down to $-448°$. The bulk of a given mass of air, therefore, under a constant pressure, varies as its temperature reckoned from $-448°$ on the common scale; that is, as $t + 448$, the degrees of Fahrenheit being t. Hence, by art. 1, the pressure of air confined in an inextensible vessel, likewise varies as $t + 448$.

Relation between the variations of heat in air and those of its volume or pressure.

We shall now apply these principles to determine the scale of temperature for air. Let ABC be a curve, such that, while AHIB, its area between any two ordinates, denotes an addition to the heat contained in a given mass of air, the straight line HI shows on the common scale the consequent rise of temperature, under a constant pressure, viz. from H to I, as indicated on the common scale of an air thermometer. Let DEF be a similar curve, making AH : DH :: m : n, and cutting all the other ordinates and areas of ABC in that same ratio. Hence, area DHIE is equal to $\frac{n}{m}$ (AHIB), and it therefore (art. 2) represents the smaller addition of heat which would be sufficient to raise the temperature of the same air from H to I, were that air, in place of being free to expand under a constant pressure, confined in an inextensible vessel. For since the specific heats or the minute increments are always in the ratio of m to n, so must any larger addition of heat raising the temperature from H to I under a constant pressure, be to that producing the same rise under a constant volume. Let the common scale, of which HI is a part, be continued downward to the point G answering to $-448°$ Fahrenheit; then (art. 5) the volume of the air is increased, under a constant pressure, in the ratio of GI to GH, by its temperature being raised from H to I. Suppose, therefore, that the air, after having, under a constant pressure, received an increase in its total heat equal to AHIB, and thereby acquired the temperature I, is instantly compressed to its original volume; by which means its temperature is suddenly raised from I to K on the common scale, in such a manner that area DHKF = AHIB; because the air is evidently now raised to the same temperature, and in every respect brought to the same state as if, with its original volume all the while invariable, it had received the same increase in its quantity of heat as is mentioned above, and which is now denoted by area DHKF instead of AHIB.



While the air was thus being compressed to its original volume, or the density re-increased in the ratio of GI to GH, the pressure has been thereby increased (art. 1) in the same ratio compounded (art. 5) with the ratio of GK to GI for the second rise of temperature; that is, in the ratio of GK to GH; and during this compression the total quantity of heat in the air is supposed to be constant. Hence,

$$\text{(art. 3)} \; \frac{GK}{GH} = \frac{p}{p'} ; \; \frac{GI}{GH} \frac{\varrho}{\varrho'} \text{ ; } n \log. \frac{GK}{GH} = m \log. \frac{GI}{GH},$$

and therefore log. GK — log. GH : log. GI — log. GH :: $m : n$. But we have also area AHKC : AHIB :: $m : n$, because AHIB = DHKF; and the same thing holds at any part of the curves. Consequently, by the lemma, each of these curves is a hyperbola, having G for its centre and GH for an asymptote.

All the preceding reasoning evidently applies as well to the accented letters in the lower part of the figure, where AHI′B′, the area between any two ordinates, denotes a loss of heat, HI′ the consequent depression of temperature on the common scale in cooling from H to I′ under a constant pressure, and I′K′ a farther depression, such that area DHK′F′ = AHI′B′; being caused by suddenly dilating, to its original volume, the air which had just been contracted by cooling from H to I′.

Relation between the variations of heat in air and those of its volume or pressure.

Since in each curve the segments of the area denote variations of heat, while the corresponding segments of the abscissæ denote variations of temperature on the common scale, it follows from the known property of the hyperbola, that while the variations of the quantity of heat in air under a constant pressure are uniform, those on the common scale of an air-thermometer form a geometrical progression. Or, in more general terms, while the variations in the quantity of heat in air are uniform, the variations of its volume, under a constant pressure, form a geometrical progression, as do likewise the variations of pressure under a constant volume.

Hence, in place of being equal, the divisions on a true scale of an air-thermometer should form a geometrical progression, increasing upward, such that the length of each division may be proportional to its distance from — 448° F.; and hence also the values of the degrees usually put on Fahrenheit's scale of an air-thermometer decrease upward, the value of each being inversely as its distance from — 448°. The same thing holds regarding any other scale with equal divisions.

Such are some of the necessary results of the very principles from which MM. de Laplace and Poisson failed to deduce a corresponding scale of temperature; we mean a scale which should necessarily follow from, and be compatible with, the law of Boyle and the foresaid *constancy* in the ratio of m to n. But having failed in this, they attempted to supply the defect, by *assuming* that the variations in the quantity of heat in air, under a constant pressure, are proportional to the corresponding variations on the common scale of an air-thermometer. We shall merely notice so much of their investigation here as will be sufficient to show the utter incompatibility of such an *assumption* with the two principles just named. These illustrious philosophers set out with an equation which, adapted to Fahrenheit's scale, is

$$p = a\varrho\left(\frac{t + 448}{\tau + 448}\right).$$

To this we have no objection. It just expresses the relation between the law of Boyle and the common scale; p being the pressure, ϱ the density, and t the temperature, of a given mass of air; also a is a constant and τ a given temperature on Fahrenheit's scale. Having next introduced the assumption in question, they obtain the equation,

$$q = \mathrm{A} + \mathrm{B}\,(t + 448)\,p^{\frac{-m}{m}},$$

where q is the quantity of heat to be added or withdrawn, in order to change the temperature of the given mass of air from τ to t; A and B are constants, and m and n numbers in the constant ratio already defined. By combining the two equations, we have likewise

$$q = \mathrm{A} + \frac{\mathrm{B}\,(\tau + 448)\,p^{\frac{n}{m}}}{a\varrho}$$

Taking the fluxion of this with the density ϱ constant, we have dq varying, as $p^{\frac{n}{m}-1}\,dp$. But the constancy in the ratio of m to n provides that the change to be made in the quantity of heat in air, in order to produce a given change in its temperature, under a constant pressure, must be proportional to the change of heat necessary to produce the same change of temperature, were the volume constant; and it is well known to be the same thing, whether variations of temperature on the common scale are reckoned by the variations of volume under a constant pressure, or by variations of pressure under a constant volume. Hence Laplace and Poisson assume the variations in the quantity of heat to be proportional, as well to the variations of pressure under a constant volume, as to the variations of volume under a constant pressure. Wherefore dq varies as dp simply; but we have just seen that it likewise varies as $p^{\frac{n}{m}-1}\,dp$. Consequently $p^{\frac{n}{m}-1}\,dp$ varies as dp; and dividing by dp, we have $p^{\frac{n}{m}-1}$ varying as a constant quantity, which is extremely absurd. Yet the very same data and assumption which give rise to this contradiction, form the foundation of many intricate formulæ in the *Mécanique Céleste*, and of a very long memoir on heat by M. Poisson, in the eighth volume of the *Mémoires de l'Académie*.

From the remarkable inconsistency just pointed out in the principles adopted by these illustrious philosophers, it is evident that they had not had so much as a conjecture of what the legitimate result should be. Nobody wonders when a research of this sort fails in the hands of an inexperienced tyro; but if those who are deservedly regarded as at the head of their profession be liable to deceive themselves in so remarkable a manner, how cautious ought we to be in receiving even what emanates from high authority, if accompanied by nothing deserving the name of argument or intelligible evidence; for the foregoing investigation, we presume, will be found to be both legitimate, and to depend on nothing but admitted principles. It is long since our distinguished countryman, Dr Dalton, proposed what he alleged to be the true scale of the mercurial thermometer, founded on the supposition that the expansions of liquids were everywhere as the squares of their true temperatures, setting out from the greatest density of each. With this he coupled another speculation: he supposed that, relatively to equal intervals on his new scale of temperature, the expansions of air, or of any other gas, under a constant pressure, formed a geometrical progression; which evidently was a very different scale from the one we have deduced above, because, as will presently be seen, it bore such a different relation to the expansion of mercury. For, unfortunately, these views, which Dr Dalton had never shown to be necessarily deducible from admitted principles, were soon found to be mutually incompatible; but of the two hypotheses, that regarding the expansion of mercury being the greater favourite with Dr Dalton, he rather chose to retain it, and abandon the one respecting the expansion of air; in place of which, he has since, in his *Chemical Philosophy* (vol. ii. p. 298, published in 1827), adopted the very different notion, that it is the forces of steam, and of other vapours in the state of saturation, which form geometrical progressions for equal intervals of temperature. It was absolutely necessary that the one of his former hypotheses should be relinquished; for they were not only inconsistent at extreme temperatures, but they required the common mercurial thermometer to be more than 7° below the common air-thermometer at 122° F.; whereas at that point, several eminent French chemists declared they could find no such difference; and in their decision Dr Dalton at length acquiesced.

Hy ome- y.

However, from the recent comparison of these two instruments by Dr Prout, it appears that their indications do not everywhere coincide throughout the interval between the freezing and boiling points of water; but their difference is quite of the contrary sort to that which Dr Dalton alleged, the mercurial thermometer being in advance of the other.

It was shown (art. 3) that $\left(\frac{p}{p'}\right)^n = \left(\frac{\varrho}{\varrho'}\right)^m$; viz. that when the total quantity of heat in a given mass of air is constant, the *n*th power of the pressure varies as the *m*th power of the density; and since *m* is greater than *n*, the pressure varies faster than the density, or $\frac{p}{p'} = \left(\frac{\varrho}{\varrho'}\right)^{\frac{m}{n}}$. But in this, a part of the variation of pressure is due to change of temperature; for (art. 1) when the temperature is the same, the pressure and density vary in the same ratio. Also (by art. 1 and 5), when along with a change of density from ϱ' to ϱ, the temperature changes from τ to t, and the pressure from p' to p, they are related thus; $\frac{p}{p'} = \frac{\varrho}{\varrho'} \times \frac{t+448}{\tau+448}$; and if during this the total heat in the air undergo no change, this equation must coincide with the preceding one. Hence

Cl ge of te era- tu by co non sc due to ange of lume.

$$\frac{t+448}{\tau+448} = \left(\frac{\varrho}{\varrho'}\right)^{\frac{m-n}{n}} = \left(\frac{p}{p'}\right)^{\frac{m-n}{m}};$$

and therefore, on the common scale, the change of temperature is

$$t - \tau = (\tau + 448)\left[\left(\frac{\varrho}{\varrho'}\right)^{\frac{m-n}{n}} - 1\right]$$

$$= (\tau + 448)\left[\left(\frac{p}{p'}\right)^{\frac{m-n}{m}} - 1\right],$$

when the total quantity of heat in the air is constant. This investigation is given in general terms, but we shall soon see that *m* is to *n* either exactly or very nearly as 4 to 3; and therefore,

$$\frac{m-n}{n} = \tfrac{1}{3}, \qquad \frac{m-n}{m} = \tfrac{1}{4}.$$

Most of the formulæ which have been proposed for this purpose are fraught with inconsistencies, such as making the rise of temperature which would be produced by a quadruple compression, to be very different from the sum of the separate rises which should be produced by twice doubling the density; and they are equally faulty when we compare a quadruple dilatation with twice halving the density. Nay, when we attempt to retrace our steps by reversing either process, they do not restore the air to the same temperature and pressure which it had at first; but the formulæ now given, unless when sadly mismanaged, lead to no such inconsistencies. Thus, suppose the density of air at the temperature of 60° to be quadrupled, the rise of temperature is $(60 + 448)\left[\left(\frac{4}{1}\right)^{\frac{1}{3}} - 1\right] = 298°·4$. To effect the same thing by two separate doublings, we have first $508\,[2^{\frac{1}{3}} - 1] = 132°·04$, which, added to the initial temperature 60°, makes 192°·04; and by doubling again the density of the air at this higher temperature, the second rise is $(192·04 + 448)\,[2^{\frac{1}{3}} - 1] = 166°·36$. So that the total rise is 132·04 + 166·36 = 298°·4, the same as before. The like consistency will be found to hold with any proper trial of these formulæ. (See *Edinburgh Phil. Journ.* for July 1827, p. 153.)

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Quantity of heat evolved or absorbed by change of volume.

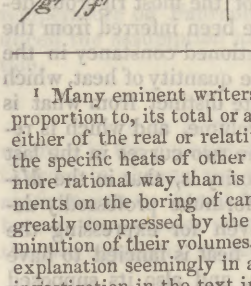
From the foregoing investigation it is likewise evident, that if the total heat in a given mass of air undergo no change, while its density is being increased in any assigned ratio, as, for instance, in the ratio of GI to GH (see the preceding figure), the temperature is thereby raised from I to K on the common scale, making area DHKF = AHIB. In this case the area EIKF = ADEB represents the heat which has been elicited from a latent state, or rendered sensible by the compression. But if, on the contrary, the density of the air were diminished in the ratio of GI′ to GH, without any change in the quantity of heat, the temperature would be thereby lowered from I′ to K′, making area DHK′F′ = AHI′B′; and area E′I′K′F′ = ADE′B′ would denote the heat absorbed by the dilatation, or rendered latent without being actually lost. Now, area EIKF $= \frac{m-n}{n}$ (DHIE) $= \frac{m-n}{m}$ (DHKF), and E′I′K′F′ $= \frac{m-n}{n}$ (DHI′E′) $= \frac{m-n}{m}$(DHK′F′); wherefore area EIKF, or the heat evolved by compression, bears the same ratio to DHIE that the $\frac{m-n}{n}$ part of the increase in the logarithm of the density bears to log. GI — log. GH; and the same is also the ratio which area E′I′K′F′, or the heat absorbed by the dilatation, bears to DHI′E′, or which the $\frac{m-n}{n}$ part of the decrease in the logarithm of the density bears to log. GI′ — log. GH. In both cases, the $\frac{m-n}{n}$ part, or one third of the change in the logarithm of the density, is equal to the $\frac{m-n}{m}$ part, or one fourth of the change in the logarithm of the pressure; the total heat remaining invariable. It matters not what sort of logarithms are used.

Specific heat of air independent of the magnitude of its volume if constant, and of the intensity of its pressure if constant.

Although the *constancy* in the ratio of the specific heats, or of *m* to *n*, as already defined, had been well ascertained by the experiments of Gay-Lussac and Welter, and been likewise adopted as a fundamental principle by the leading philosophers both here and on the Continent; yet the most important of its necessary and unavoidable consequences were long overlooked, especially how very different a graduation of the air-thermometer it requires from what they had assumed to be the true one, as was first pointed out by Mr Meikle in the *Edinburgh Phil. Journ.* for October 1826, page 336. A more obvious consequence likewise noticed in that paper, and of importance here, is, that the specific heat of the same mass of air under a constant pressure, must be independent of the *intensity* of such pressure; and that when the same mass of air is confined in an inextensible vessel, its specific heat must be independent of the *size* of that vessel. This admits of the most rigorous demonstration, and might even have been inferred from the consideration that the above-mentioned constancy in the ratio of the specific heats keeps the quantity of heat, which merely raises the temperature quite distinct from what is absorbed, or goes to enlarge the volume, and which is represented by the area between the two curves in the last figure. Now the remarkable curiosity is, that in the *Mécanique Céleste*, livre xii. chap. 3, formulæ professedly derived from the same data are given for expressing the *different* values which the specific heat is fancied to have under different constant pressures, and also its supposed *different* values under different constant volumes. The same are given by M. Poisson (*Annales de Chimie*, xxiii. 338).

M. Laplace had previously given in that journal (xviii. 185) a very different, though still a *variable* value to the specific heat of air; but this he virtually discarded, by subsequently adopting the other, though both are alike incompatible with the principles from which they profess to be deduced. Sanctioned by such names, these formulæ are and must be received as orthodox by those who never think for themselves, or who do not thoroughly examine the investigations by which such expressions are deduced. But since the clearing up of this point is of great importance in researches of this nature, we shall endeavour to put the matter beyond dispute, by giving, from the very data used by Laplace and Poisson, a very simple demonstration of what we have now alleged, and which is the more satisfactory as it does not require the law of temperature to be previously decided upon; for since the same degree may be used for the several specific heats, it may be supposed to belong to any scale.

Let therefore the temperature of a given mass of air be reckoned on any scale of which the straight line BE is a part; and let CF be a line, no matter to our present purpose whether straight or curved, if it be such that every two ordinates may, like BC and EF, intercept an area BCFE proportional to the quantity of heat which would raise the temperature of the mass of air, under a constant volume, from any point B in the scale to any other point E in it. Let DG be a similar line or curve, so as to make the area BDGE proportional to the heat which would raise the temperature of the same mass, if under a constant pressure, from B to E. Now the chief condition on which we proceed is, that the quantities of heat represented by every two areas, such as BDGE and BCFE, between the same parallels, may be to each other in the given ratio of m to n, and which is obviously the same with the ratio of any ordinate of DG to the corresponding ordinate of CF. Let the point B mark the initial temperature, whatever that may be, of the given mass of air; raise this temperature from B to any other point E under a constant pressure; make Ee one degree, draw the ordinate efg. Then area EGge is the specific heat, at the temperature E, of the same mass of air dilated by heat under the original pressure remaining constant. Now the specific heat, when the pressure is constant, is always to the specific heat when the volume is constant as m to n; but area EGge : EFfe : : m : n; wherefore EFfe would be the specific heat at the temperature E, under the dilated volume, were it made constant. But since area BCFE is the quantity of heat which would raise the temperature from B to E under the original volume, and area EFfe the heat which would raise it one degree more; therefore EFfe would still have been the specific heat of the same mass of air at the temperature E, and all the while under the original volume. Hence EFfe is the specific heat of the same mass of air at the temperature E, whether under the *dilated* volume remaining constant, or under the *original* volume constant.



Again, suppose the air to be heated up from B to E under the original volume remaining constant, by which means the pressure will be gradually augmented; but by the data, the specific heat at the temperature E, under the augmented pressure, were that now made constant, must exceed EFfe in the ratio of m to n; wherefore EGge, which exceeds EFfe in that ratio, is the specific heat of the same mass of air at the temperature E, whether under the *augmented* pressure remaining constant, or, as in the first case above mentioned, under the *original* pressure constant. The same conclusions would obviously follow by a similar process of reasoning, taking the second temperature at any point E′ lower than B. Both cases might also be proved in several ways, a little differently from the preceding; as, for instance, by showing that EFfe or E′F′$f'e'$ will be the specific heat of the same mass of air under a constant volume, as well after the temperature has been changed from B to E or E′ by a change in the quantity of heat only, as by a change in the volume only; and of course EGge or E′G′$g'e'$ will be the corresponding specific heat under a constant pressure, whether under the original pressure constant, or under the pressure made constant after being thus changed.

It is thus clearly established as a necessary result of admitting the *constancy* of the ratio above mentioned, that neither the *magnitude* of a constant volume, nor the *intensity* of a constant pressure, has any thing to do with the specific heat of a given *mass* of air.[1] From this it is obvious that the specific heat of a given *volume* of air is, *cæteris paribus*, as its mass or density.

The experiments of Desormes and Clement on the specific heats of gases (*Journal de Physique* for December 1819), have been supposed to make the specific heat of a given volume of air to vary as the square root of its density; but we do not see how they warrant any thing of the sort. These distinguished chemists having enclosed air in a glass globe, placed it in an empty trough, which they next filled up with hot water, and assumed that the specific heat of the air was exactly proportional to the time which it and the globe took to acquire the same temperature with the water; whereas, for aught that is known to the contrary, the specific heat of the air might follow some other power or root, or some very complex function of the time. Nor do they make any allowance for the share which the mass or matter of this globe, which far exceeded that of the included air, had in protracting the time; or for the different mobilities, and consequently different conducting powers, of different gases, or of the same gas at different pressures. Thus, when the globe was filled with hydrogen, it was probably from the extreme mobility and great conducting power of that gas that the time of its attaining the temperature of the hot water was scarcely two thirds of that in the case of air; and it is as natural to think, that when filled with carbonic acid, it was the more sluggish motions of that gas which rendered the time one half longer than in the case of air; for the experiments of Dr Haycraft

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[1] Many eminent writers, without any evidence, take it for granted that the specific heat of a body depends on, or is in exact proportion to, its total or absolute heat; which is the more remarkable, considering that nothing is yet known, or likely ever to be, either of the real or relative values of the absolute heats of different bodies. But if we suppose, with far greater probability, that the specific heats of other bodies, as well as that of air, have no dependence on their volumes, this would enable us to account, in a more rational way than is usually done, for the heat accompanying friction, as, for instance, in Count Rumford's well-known experiments on the boring of cannon. Thus the grains of metal worn off by the intentionally blunt borer used on that occasion would be greatly compressed by the abrasion, and so might emit much heat without having their specific heats in the least impaired by the diminution of their volumes. In this way too the evolution of heat would continue as long as the wear and friction; which affords an explanation seemingly in accordance with the fact, without having recourse to the old notion that heat is a species of motion. The investigation in the text indeed implies that the absolute heat of air is indefinitely greater than its specific heat; and certainly many difficulties could be explained on the supposition that the same thing holds of bodies generally, or that all the heat we can impart to or abstract from bodies bears no proportion to their absolute heats.

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(*Trans. Roy. Soc. Edin.* vol. x. p. 195) are free from all such objections, and show that, under equal volumes and pressures, the specific heats of the different gases are equal, a result equally fatal to the conclusions which were deduced from the excessively complicated method of MM. Delaroche and Berard. If, therefore, the experiments of Desormes and Clement are so very erroneous for comparing the specific heats of different gases, why should we put any confidence in them for that of the same gas under different pressures?

Experiments somewhat similar to those just noticed have been made by MM. de la Rive and Marcet, and described in the *Annales de Chimie* for May 1829; but in an article on the same subject in the next number of that journal, M. Dulong has shown, that in these experiments, from their being made on an exceedingly minute scale, the mass of air operated on was so very small, compared with that of the vessel, that they do not warrant any definite conclusion at all. We are scarcely better satisfied with the method which M. Dulong himself has there employed for estimating the specific heats of the gases from the frequency of their vibrations, as supposed to be registered by a kind of wind-instrument coupled with wheel-work, and called a *sirène;* because that method involves several questions not yet cleared up. But what we particularly object to is, that no allowance is made for the tendency which it is natural to think the vibrations of the materials of the wind-instrument itself must have to increase the frequency of the vibrations of the gas under examination; an oversight similar to what, as we shall by and by see, pervades the usually received theory of sound. Nor can there be a doubt that the vibrations of strings, wires, &c. in musical instruments are influenced by the vibrations of the materials by which they are stretched.

Experiments for determining the constants.

Having completed the intended investigations, it may now be useful to give some account of the experiments to which we have several times alluded, for ascertaining the value and constancy of the ratio of m to n. We shall first give a familiar illustration of the principle, and then state more nearly the actual mode of experimenting. Suppose a vessel to be accurately closed, when occupied by air of the same temperature and pressure as that around it or in the apartment, and to be furnished with a gauge for showing any minute change of pressure. In this state let the apparatus be carried into another room of a little higher temperature, say m degrees warmer than the former; and then the gauge will soon indicate an increase of elasticity, which we may call m degrees. If the vessel admit of being now opened sufficiently, and shut again so promptly as just for the moment to allow the included air to regain the external or its original pressure, without affording time for its abstracting heat from the materials of the vessel, the gauge will in a little time indicate a second but much smaller increase of pressure, which we may call $m - n$ degrees. The reason of this may be traced in a general way to the well-known fact, that air of whatever density is cooled by dilatation. The gauge, while indicating m degrees, shows the included air to be denser than that in the second apartment; and therefore, on opening the vessel, the superior elastic force within expels a portion of that air, leaving the remainder of course rarer than that of the first room, though still a little denser than that of the second; because it has been cooled, as the result shows, $m - n$ degrees below the temperature of the second room. For at the instant of re-shutting the vessel, the elasticity of the included air is in equilibrio with the external pressure; but it must then be more dense than the air of the second apartment, otherwise, its temperature being lower, it could not balance the external pressure. On recovering therefore from the small and momentary depression of temperature, the excess of density shows itself by the gauge. The escape of a small portion of air while the vessel is open does not alter the result, because it only carries off its own heat. By this mode of operating, the ratio between the small quantities m and $m - n$ can evidently be ascertained with incomparably greater exactness than by any thermometer whatever. The distinguished German philosopher Lambert had long ago contrived to operate on air in such a way that it showed the changes of its own temperature; and no doubt it has been the uncertainty attending the employment of thermometers in more recent researches on air, that has led to such strange and paradoxical results, and which has called in the aid of so many fanciful hypotheses regarding the nature of heat. Indeed there is no time for a thermometer of any sort acquiring the minute change of temperature denoted by $m - n$.

Since we shall presently see that m is to n either exactly or very nearly as 4 to 3, it will conduce to greater simplicity if we now give this value to that ratio. But it is obvious, that during the small moment the vessel was open, the air which remained in it, having its temperature slightly depressed, could not lose heat, and had not time to gain any; so that the total heat in that remainder may be regarded as constant during the operation. Hence the same quantity of heat which had been sufficient to keep the air m degrees or 4° above its original temperature while confined in the vessel, shows itself to be only able, while again put under the original pressure, to maintain an excess of n degrees or 3° above that same temperature. The variation of heat, therefore, which would produce a given minute change, for instance, one degree in the temperature of air, and which variation is usually called its specific heat, must be one third greater when the air is free to change its volume under a constant pressure, than if confined in an inextensible vessel.

It is evident that the experiment would be essentially the same, if the vessel, in place of being brought from a colder apartment, were to have as much additional air injected into it as should make the gauge indicate 4° above the external pressure, after the temperature of the included air has settled to that of the room; the rest of the process, as to opening and promptly shutting again the vessel, being as already described. Now, in either method it is obvious, that at the instant of suddenly re-shutting the vessel, the included air, being brought to an equilibrium with the atmosphere, had, with reference to pressure, lost all the additional 4°; while, as the second indication of the gauge, viz. 1°, shows it had only lost 3° with regard to density, one of the lost degrees of pressure being therefore due to momentary depression of temperature. Hence, the height of the barometer, or whole pressure, is to the variation of pressure denoted by 4°, as p to dp. Also the height of the barometer, or whole density, is to the variation of density denoted by 3°, as ϱ to $d\varrho$. Consequently, $p : 3dp :: \varrho : 4d\varrho$.

Such is nearly the mode of experimenting followed by Mr Meikle, as detailed at length in the *Edinburgh Phil. Journ.* for April 1827, and more recently repeated with an improved apparatus, fully as large as the former one, which contained 2310 cubic inches, but with the advantage of having four apertures, amounting together to twenty-five square inches, which can be both opened and shut again so promptly, that the time of their being open is only a small fraction of a second. Something similar had been previously practised, though with a less perfect apparatus (*Journal de Physique* for Nov. 1819, p. 331), by MM. Desormes and Clement, and had likewise, at the desire of Marquis de Laplace (*Mécanique Céleste*, livre xii. chap. 3, and *Conn. des Temps* for 1825, p. 372), been adopted by MM. Gay-Lussac and Welter, who continued it through a great range both of temperature and pressure; but they do not make the simultaneous variations of density and pressure

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exactly such, that $p : 3dp :: \varrho : 4d\varrho$, which is very nearly the relation obtained by Mr Meikle from a mean of many experiments, and with either apparatus; but they make $p : 3dp :: \varrho : 4{\cdot}1244d\varrho$. The difference is not very considerable; and the following consideration, we think, renders it extremely probable that the former is the true relation. Sir Isaac Newton has shown (*Principia*, lib. ii. prop. 23), that if in an elastic fluid the cube of the pressure vary as the $r + 2$ power of the density, the particles should repel each other with forces inversely as the rth powers of their distances; and similar investigations and results may be seen in other elementary works. Now, these experiments of the French philosophers just named make the cube of the pressure proportional to the 4·1244 power of the density, as is evident if we put 3 and 4·1244 in place of n and m in art. 3. Hence $r = 2{\cdot}1244$, and therefore the particles would repel each other with forces inversely as the 2·1244 powers of their distances; a law of which there is no known parallel in nature. But if the ratio of n to m were that of 3 to 4, and these numbers were substituted as indices in art. 3, we should have $\left(\frac{p}{p'}\right)^3 = \left(\frac{\varrho}{\varrho'}\right)^4$, or the cube of the pressure varying as the fourth power of the density; and consequently, the repulsion between the particles of the air would vary inversely as the squares of their distances, which is the only known law of repulsion, and most likely the only one which exists.

Particles of air repel each other with forces inversely as the squares of their distances.

It had long been well known in a general way, that when air has its volume or bulk changed so suddenly as to afford little or no time during the process for its either imparting heat to or receiving it from surrounding bodies, the pressure is at that instant changed in a much higher ratio than the density is. This was quite sufficient to render it certain, that whatever might be precisely the true law of repulsion, it must follow something very different from the reciprocal of the simple distance, which supposes the pressure and density to vary in the same ratio. For it was as well known, that during cases where the pressure has varied in the same ratio as the density, time enough has always elapsed for the air either imparting to or receiving from surrounding bodies as much heat as it may either have evolved by compression or absorbed by dilatation; because compression, by tending to warm the air, induces it to give out heat, and dilatation, by tending to cool the air, induces it to receive heat. But when, from cases in which the pressure had varied in the same ratio as the density, Newton inferred that the particles of air repelled each other with forces inversely as their simple distances, he was quite excusable; because the facts just noticed were not known in his time, nor were they indeed attended to till towards the end of last century. The like excuse, however, cannot so well be pleaded for Dr Dalton, who, in speculating on the constitution of the atmosphere so lately as in the *Phil. Trans.* for 1826, just adopts the law of repulsion deduced by Newton, and without making the slightest objection to it on the score now stated. The French savans, again, in having virtually made the repulsion vary inversely as the 2·1244 power of the distance, seem to have run a little into the opposite extreme. But when they adopted that conclusion, they were perhaps influenced a little by Laplace's theory of sound, which required something of the sort to help it out, and for which indeed the experiments of Gay-Lussac and Welter were purposely undertaken. The defect of the theory, we presume, lies rather in its not including the share which it is likely the re-action of the earth's surface has in accelerating the transmission of sound. For it seems reasonable to think, that since the air presses strongly on the earth's surface, it must, while propagating sound, both set that surface a vibrating, and, in return, have its own vibrations accelerated thereby; because the vibrations of the earth's surface should incline to be more frequent than those of air. Such at least seems to be the case with the vibrations of solids and liquids generally; though these again differ widely among themselves, and should of course affect the velocity of sound differently. According to this suggestion, the louder or the more intense the sound, the more fully will the earth's surface be brought into action, and consequently the greater, *cæteris paribus*, should be its accelerating influence. A similar defect, as we hinted above, seems to attach to the many attempts which have been made to determine the frequency of the vibrations of elastic fluids by means of wind-instruments; no allowance being made for the influence which it is likely the vibrations of the materials composing the wind-instruments have on the frequency of the vibrations of the gas under examination.

Probable defect in the theory of sound, and of the vibrations of gases.

We shall now enter on the consideration of hygrometers which are formed of materials comparatively free from decay, which are constant or consistent in their indications, and which, in short, seem in a great measure to possess the first five of the properties already specified, which Saussure considered necessary to a perfect hygrometer: as for his sixth, we regard it as supererogatory. The fact that humid air readily wets bodies which are colder than itself, such as stones and walls at the commencement of a thaw, must have been familiar to mankind from the remotest antiquity; though it has not been long known that dew or hoar-frost affords the most universal example of this all the world over; being moisture deposited on bodies which have been sufficiently cooled by radiation below the temperature of the incumbent air. The ancients appear to have conjectured that a copious deposition of moisture on cold bodies prognosticated bad weather; but the first step perhaps towards applying this principle to the construction of a hygrometer was made by the Florentine academicians, who having suspended in the open air a conical vessel filled with snow or pounded ice, supposed the humidity of the air to be proportional to the quantity of moisture which, being condensed on the exterior surface of this vessel, trickled down its sides, and dropt from the apex of the cone. This, however, could afford but a very vague estimate of the humidity of the air; because the quantity of moisture thus collected must obviously have depended in a great measure on the velocity of the wind; and such an estimate would be still more erroneous, or rather useless altogether, in the time of frost. The same idea was farther improved upon by M. Leroy of Montpellier, who, by dropping ice into water contained in a vessel with a bright exterior surface, gradually lowered its temperature, till dew began to be deposited from the contiguous air on that surface. Saussure substituted sal ammoniac for ice, and different salts have been employed by others for the same purpose. The temperature to which the vessel is thus brought at the moment of incipient deposition, is obviously the temperature to which, if the air were cooled under the same pressure, the vapour in it would be in a state of saturation, or ready to deposit dew upon any thing in the least degree colder than itself. Such temperature is therefore denominated the *dew-point*. Did the air, in cooling, undergo no diminution of volume, it would not be brought to a state of saturation with moisture, till it were cooled below t, the temperature of the air through a range greater nearly in the ratio of $1 + \frac{t + 448}{8600}$ to 1 than that which brings it to the dew-point. Some writers do not seem aware of there being any difference between these points of saturation; and others have such confused notions of it, that not unfrequently they transpose them; though no-

More durable class of hygrometers.

thing is more certain than that these temperatures cannot be the same, and that the dew-point is the higher of the two. For if t be the actual temperature of the air, and t'' the dew-point, since the pressure is the same in both cases, the actual density of the air is to its density when cooled to the dew-point, in the inverse ratio of $t + 448°$ to $t'' + 448°$, as was shown above regarding the expansion of air; but since all elastic fluids yet tried expand or contract at the same rate by the same change of temperature, the density of the vapour at the dew-point must therefore be greater in the above ratio than its density at the actual temperature, which is the same as its density would be were the air cooled without shrinkage. This, however, is not meant to prove the above ratio to be the very law of nature.

The following table is for facilitating computations of this kind. The first column is the Fahrenheit temperature t; the second the maximum force f of aqueous vapour for that temperature; the third the corresponding weight of moisture in a cubic foot expressed in grains. The fourth column, computed from the formula $\frac{t + 448}{480}$, shows the ratio in which an elastic fluid is expanded or contracted by having its temperature changed from 32° to t; and this column, being everywhere in the ratio of the temperature reckoned from — 448°, may therefore denote either the volume of a given mass of elastic fluid under a constant pressure, or the pressure under a constant volume, the unit of each being at 32°. The second column is computed from the formula which M. Biot has deduced from Dr Dalton's experiments, viz.

$$\log. f = 1{\cdot}4771213 - {\cdot}0085412197\,(212 - t) - {\cdot}0000208109\,(212 - t)^2 + {\cdot}0000000058\,(212 - t)^3;$$

but we have slightly increased a few of the numbers next zero, to correspond with the experiments of Gay-Lussac, because those of Dr Dalton did not go lower than 32°.[1] Vapours of all sorts, so far as yet tried, are found to observe the general laws of elastic fluids, in having the density directly as the pressure, and inversely as $t + 448$; and from the experiments of Dr Rice it appears that a cubic foot of water at 40° weighs 437,272 grains; and this again M. Gay-Lussac found to be 1700 times heavier than a cubic foot of aqueous vapour at 212°, which therefore weighs 257·2188 grains. Hence, to obtain the numbers for the third column, we have

$$\frac{30}{212 + 448} : \frac{f}{t + 448} :: 257{\cdot}2188 : \frac{5658{\cdot}81 f}{t + 448},$$

the number of grains in a cubic foot of aqueous vapour in a state of saturation, at the temperature t.

But when the vapour is not in a state of saturation, as, for instance, when the actual temperature of the air is 60°, and the dew-point only 40°, we proceed thus:—Opposite 40° in the first column of the table we find ·2644 inch in the second for the actual force of vapour in the air; but from what has been shown above regarding the expansion of elastic fluids, the density at 60°, corresponding to a force of ·2644, must be less than if the temperature were 40°, in the ratio of 40 + 448 to 60 + 448, or of 1·0167 to 1·0583 (viz. using the numbers in the fourth column opposite 40° and 60°). We must therefore reduce in that ratio the maximum weight in a cubic foot at 40°, namely, 3·066 grains, which will make it $\frac{1{\cdot}0167}{1{\cdot}0583} \times 3{\cdot}066 = 2{\cdot}945$ grains for the actual weight of moisture in the air, corresponding to a temperature of 38°·8; so that, had the air been cooled down to 38°·8, without shrinkage, or under the original volume, the vapour would have been brought to a state of saturation. The temperature 38°·8, as already observed, is lower than the dew-point by very nearly $\frac{t + 448}{8600}$ times the difference between the dew-point and the temperature of the air. Thus $38°{\cdot}8 = 40° - (60 - 40)\frac{508}{8600}$; which affords a ready mode of computing this lower point of saturation without the aid of any table.

It is much more convenient to use the grains in a cubic foot than the small fraction of a grain in a cubic inch; because the latter requires more figures to express it with the same accuracy. But it is not so much from pretensions to superior exactness that we use so many decimal places in these columns, as to render the differences of the numbers more uniform, which is of consequence when there is any occasion for taking proportional parts, or interpolating between them.

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[1] The committee of the Royal Academy of Sciences at Paris, who made a very elaborate and extensive series of experiments on the force of steam in 1829, as described at length in the *Ann. de Chim.* for January 1830, give the following formula:

$$e = \left(1 + {\cdot}007153\,(T - 100)\right)^5,$$

where e is the elasticity in atmospheres, and T the temperature centigrade. This expression, however, becomes far too small at low temperatures, and vanishes altogether at the freezing point of mercury. M. Roche, again, makes

$$\log.\ e = \frac{T - 100}{T + 266{\cdot}67} \times 5{\cdot}48.$$

But neither can any expression of this form be the law of nature; because, besides erring considerably at temperatures within the range of observation, it would require the density of saturated steam to reach a maximum, and then decrease; so that some of it would become liquid by the addition of more heat, which is quite incredible. Indeed every formula which, so far as we know, has yet been published, for expressing the force of steam, is liable to some such objections.

Table of the Force, Weight, and Ratio of Expansion, of Aqueous Vapour in a state of Saturation, from 0° *Fahrenheit to* 100°.

Temperature.	Force in Inches.	Grains in a Foot.	Ratio of Expansion.	Temperature.	Force in Inches.	Grains in a Foot.	Ratio of Expansion.
0°	·0622	·786	·9333	50°	·3735	4·244	1·0375
1	·0643	·810	·9354	51	·3864	4·382	1·0396
2	·0665	·836	·9375	52	·3998	4·524	1·0417
3	·0688	·864	·9396	53	·4136	4·671	1·0438
4	·0713	·893	·9417	54	·4278	4·822	1·0458
5	·0740	·925	·9438	55	·4425	4·978	1·0479
6	·0769	·957	·9458	56	·4576	5·138	1·0500
7	·0798	·992	·9479	57	·4733	5·303	1·0521
8	·0829	1·028	·9500	58	·4894	5·473	1·0542
9	·0860	1·065	·9521	59	·5060	5·648	1·0562
10	·0893	1·103	·9542	60	·5232	5·828	1·0583
11	·0927	1·143	·9563	61	·5409	6·013	1·0604
12	·0962	1·184	·9583	62	·5591	6·204	1·0625
13	·0999	1·226	·9604	63	·5780	6·400	1·0646
14	·1036	1·270	·9625	64	·5974	6·602	1·0667
15	·1076	1·315	·9646	65	·6173	6·810	1·0688
16	·1116	1·361	·9667	66	·6380	7·024	1·0708
17	·1158	1·409	·9688	67	·6592	7·243	1·0729
18	·1201	1·459	·9708	68	·6811	7·469	1·0750
19	·1246	1·510	·9729	69	·7036	7·702	1·0771
20	·1293	1·563	·9750	70	·7269	7·941	1·0792
21	·1341	1·618	·9771	71	·7508	8·186	1·0813
22	·1391	1·674	·9792	72	·7755	8·439	1·0833
23	·1442	1·733	·9813	73	·8009	8·699	1·0854
24	·1495	1·793	·9833	74	·8271	8·966	1·0875
25	·1551	1·855	·9854	75	·8541	9·241	1·0896
26	·1608	1·919	·9875	76	·8818	9·523	1·0917
27	·1667	1·986	·9896	77	·9104	9·813	1·0938
28	·1728	2·054	·9917	78	·9399	10·111	1·0958
29	·1791	2·125	·9938	79	·9702	10·417	1·0979
30	·1856	2·197	·9958	80	1·0014	10·732	1·1000
31	·1924	2·273	·9979	81	1·0335	11·055	1·1021
32	·1993	2·350	1·0000	82	1·0666	11·388	1·1042
33	·2066	2·430	1·0021	83	1·1006	11·729	1·1063
34	·2140	2·513	1·0042	84	1·1356	12·079	1·1083
35	·2218	2·598	1·0062	85	1·1716	12·439	1·1104
36	·2297	2·686	1·0083	86	1·2087	12·808	1·1125
37	·2380	2·776	1·0104	87	1·2468	13·185	1·1146
38	·2465	2·870	1·0125	88	1·2860	13·577	1·1167
39	·2553	2·966	1·0146	89	1·3264	13·977	1·1187
40	·2644	3·066	1·0167	90	1·3679	14·387	1·1208
41	·2738	3·168	1·0187	91	1·4106	14·809	1·1229
42	·2835	3·274	1·0208	92	1·4544	15·241	1·1250
43	·2935	3·382	1·0229	93	1·4995	15·684	1·1271
44	·3038	3·495	1·0250	94	1·5459	16·140	1·1292
45	·3145	3·610	1·0271	95	1·5935	16·607	1·1313
46	·3256	3·729	1·0292	96	1·6425	17·086	1·1333
47	·3368	3·851	1·0313	97	1·6929	17·577	1·1354
48	·3488	3·979	1·0333	98	1·7446	18·081	1·1375
49	·3609	4·109	1·0354	99	1·7978	18·598	1·1396
50	·3735	4·244	1·0375	100	1·8524	19·129	1·1417

Daniell's hygrometer.

The principles already explained will make the construction and use of Professor Daniell's elegant instrument easily understood. It is represented in its full dimensions in fig. 8, Plate CCXCV. where *a* and *b* are two thin glass balls of 1·25 inch in diameter, connected by a tube having a bore of about ·125 inch. The tube is bent at right angles over the two balls; and the arm *bc* contains a small thermometer *de*, whose bulb, which is of an oval form, descends into the ball *b*. This ball having been about two thirds filled with ether, is heated over a lamp till the liquid boils, and the vapour issues from the capillary tube *f* on the under side of the ball *a*. The vapour having expelled the air from both balls, the capillary tube *f* is hermetically closed by the flame of a lamp. This process is familiar to those who are accustomed to blow glass, and may be known to have succeeded after the tube has become cool, by reversing the instrument, and taking one of the balls in the hand, the heat of which will cause the ether to boil rapidly, and pass wholly over by distillation into the other ball. The ball *a* is now to be covered with a piece of muslin. The stand *gh* is of brass, and the transverse socket *i* is made to hold the glass tube in the manner of a spring, allowing it to turn and be taken out with little difficulty. Another small thermometer *kl* is inserted into the pillar of the stand. The manner of using the instrument is this:—After having driven all the ether

Hygrometry. into the ball b by the heat of the hand applied to the ball a, the instrument is to be placed at an open window, or out of doors, with the ball b so situated as that the surface of the liquid may be upon a level with the eye of the observer. A little ether is then to be dropped upon the covered ball. Evaporation immediately takes place, which, by abstracting heat, cools the ball a, and causes a rapid and continuous condensation of the ethereal vapour within it, together with a diminution of pressure. The consequent evaporation from the included ether produces a depression of temperature in the ball b, the degree of which is measured by the thermometer de. This action is almost instantaneous, and the thermometer begins to fall in two seconds after the ether has been dropped. A depression of thirty or forty degrees is easily produced, and the ether may be sometimes seen to boil when the thermometer is below the zero of Fahrenheit. So soon as the ball b is cooled by this artificial process down to the dew-point of the surrounding air, a condensation of the atmospheric moisture takes place upon its surface, and this first makes its appearance in a narrow ring of dew on a level with the surface of the ether. The temperature at which this occurs, viz. the dew-point, is to be carefully noted. A little practice may be necessary to seize the exact moment of first deposition, but certainty is very soon acquired. It is advisable, when the ball b of the instrument has been made of transparent glass, to have some dark object behind it, such as a house or a tree, because the cloud is not so readily perceived against the sky or open horizon. The depression of temperature is first produced at the surface of the liquid, where evaporation takes place, and the currents which immediately ensue to effect an equilibrium are very perceptible. We may here remark by the by, that since the covered ball a must be fully the colder of the two, there is reason to think, that while it is throwing off and furnishing latent heat for ethereal vapour, it is very likely condensing aqueous vapour and absorbing its latent heat. The bulb of the enclosed thermometer de is but partially immersed in the ether, with the view of making the line of greatest cold pass through it; but this we shall find to be a faulty arrangement. In very damp or windy weather, the ether should be very slowly dropped upon the ball, otherwise the descent of the thermometer will be so rapid as to render it extremely difficult to be certain of the degree at which deposition commences. In dry weather, on the contrary, the ball requires to be well wetted more than once, to produce a sufficient cold. If at any time there should be reason to suspect the accuracy of an observation, it may, according to Mr Daniell, be corrected by observing the temperature at which the dew upon the glass again disappears: the mean of the two observations should give the true result; because their errors, he thinks, if any, should lie in contrary directions. This, however, is on the supposition that the error lies all with the observer, and that the instrument itself is faultless; whereas we shall shortly see reason to conclude that, unless it be agitated during an observation, it has a tendency to give the dew-point too high, owing to every part of the bulb of the included thermometer not being alike exposed to the cooling effects of the ether. It is obvious that care should be taken not to permit the breath to come into contact with the glass.

Mr Daniell's hygrometer may also be applied to artificial atmospheres, and experiments on air or other gas confined in a vessel. Fig. 9 represents a receiver and hygrometer prepared for this purpose; and the following is the manner in which they were fitted up. A hole is perforated in the side of the receiver, through which the tube proceeding from the ball within it containing the thermometer is first passed, and then welded by means of a lamp to the tube attached to the other ball outside the receiver. The stem is secured in the hole of the receiver with cement, the ether is boiled, and the capillary tube closed, as before described. The external ball is then to be covered with muslin, and ether being dropped upon it, the consequent evaporation produces, in the manner already explained, a corresponding degree of coldness in the internal ball. The state of humidity within may be ascertained by noting the temperature at which dew begins to appear on that ball. In delicate experiments, a lighted taper in a glass lantern, placed behind the instrument, renders the deposition more easily visible, and ensures accuracy. The hygrometric properties of any substance, or its power of absorbing moisture, may thus be readily estimated, by placing it under the receiver, and marking the fall which it occasions in the dew-point. By means of this apparatus Mr Daniell made a variety of experiments, from which it appeared, as Deluc, Dalton, and others had asserted, that the quantity of moisture which can exist in a given volume depends solely on the temperature, and is not influenced by the presence or density of air or other elastic fluids, provided no chemical action occur.

Attempts at improving Daniell's hygrometer.

There have been various attempts to improve upon Mr Daniell's hygrometer, or to contrive a more simple one which should serve the same purpose. About ten years ago, several instruments, essentially the same in principle, though differing widely in contrivance from Mr Daniell's, were proposed in different quarters with this view. The leading features in their construction are, to cover partially the bulb of a large thermometer with muslin, silk, cambric, or the like; to wet this with ether; and to observe at what degree of that thermometer moisture is deposited on the uncovered part of its bulb. A more simple construction for directly observing the dew-point was scarcely to be expected, but unfortunately it was soon found to be very fallacious. For, owing to the uncovered part of the bulb not being directly exposed to the cooling effects of the evaporation, its temperature, viz. the dew-point, is generally several degrees higher than the mean temperature of the bulb, or that indicated on the scale of the thermometer; so that such instruments generally give a dew-point considerably below the truth, and the error is found to be greater when the bulb is of an elongated or cylindrical form than when spherical. This error may be made manifest in several ways, but the preferable one seems to be to observe the dew-point at the same time by the method of Leroy, as improved by Saussure and Dalton, namely, to cool down water in a bright vessel by dropping in colder water, ice, or salts, and to stir it with a thermometer till dew just begin to appear on the exterior surface of the vessel. The thermometer will at that instant indicate the dew-point with great accuracy if the vessel is thin, and especially if of metal.

Defect in Daniell's hygrometer.

The discovery of such a defect in these instruments led to a careful examination of Mr Daniell's hygrometer by the same test; and the result was, that it is liable to the contrary error of giving the dew-point above the truth. For since in that instrument the deposition occurs in a narrow ring or zone on a level with the surface of the enclosed ether, which, during the cooling, is considerably colder at the surface than beneath; and since the elongated bulb of the enclosed thermometer is only half immersed in this ether, it is evident that scarcely half of this bulb is subjected to so great a cold as that which produces the deposition of moisture. As to any cooling effect of the ethereal vapour on the upper half of the ball, it must be extremely feeble compared with the cooling influence of that liquid itself, as is evident from the effect which agitating the ether round the whole bulb of the thermometer has in lowering its indication. In place therefore of an observation with this hygrometer being

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"simple, expeditious, easy, and certain," it is evident, that unless the instrument is shaken, or the observation made so slowly and cautiously as to allow the bulb of the included thermometer time to become all of one temperature, it cannot fail to give the dew-point too high; so that the more clever or expeditious any one fancies himself to be in using this instrument, so much the farther is his observation likely to be from the truth.

Adie's hygrometer.

A substitute for this instrument, preferable to any of the foregoing, has been contrived by Mr John Adie, and is described in the *Edinburgh Journal of Science* (new series, vol. i. page 60). A thermometer having a small bulb is enclosed in an exterior bulb or case of black glass, which is covered with silk, excepting a small space about a quarter of an inch in diameter, where the deposition is to be observed. The space between the outer and inner bulbs is nearly filled with any liquid not liable to freeze by the depression of temperature required for finding a dew-point, as alcohol, mercury, linseed oil, &c. When an observation is to be made, ether is applied to the silk, and the instrument is kept in a state of gentle agitation, to render the inner and outer bulbs all of one temperature. With this instrument Mr Adie obtained constant results, not differing more than half a degree from Leroy's method, already described. The following table exhibits the results in twenty-eight cases, as observed with five different dew-point instruments. The first column is the temperature of the air; the second the dew-point, as observed by Leroy's method; the third, by Mr Adie's instrument; the fourth, by Mr Daniell's; the fifth, by the large thermometer, having a round bulb partially covered with muslin; the sixth, by the same kind of thermometer with an elongated or cylindrical bulb.

Temperature of the Air.	Leroy's Method.	Adie's.	Daniell's.	Spherical Bulb.	Long Bulb.
55°	45°	45°	46°	43°	41°
55	44	43·5	45	41	39
52	44	44	47	42	39
54	41	41	42	37	33·5
63	54	53·5	55	50	47
50	43	43	44	41	40
54	44	43·5	45	40	40
51	45	45	47	42	41
42	32	32	32	30	29
55	46	46	47	44	40
47	39·5	39	41	38	34
51	43	43	46	41	35
50	38	38	41	35	32
42	28	28	31	23	20
34	27	27	32	24	18
48	39	39	46	37	32
47	38·5	38·5	42	32	30
42	30	30	34	23	20
45	35	35	39	32	25
42	33	33	38	29	26
47	42	42	43	37	35
43	30	30	35	27	25
41	32	32	35	29	25
39	26	26	29	23	20
39	26	26	29	22	22
38	26	26	31	22	17
28	21	20·5	24	17	16
32	17·5	17	24	14	13
Sum 1286	1009·5	1006·5	1090	915	824·5
Mean 45·9	36·03	35·93	38·93	31·25	29·43
Mean errors..........		—0·1	+2·9	—4·78	—6·6

It has been objected to Mr Adie's instrument, that the dew being formed alike quite over the uncovered part of the outer bulb, it does not exhibit that fine contrast between the clean and bedewed parts which Mr Daniell's bulb does, and which renders the commencement of deposition better defined. But an equally good contrast, we presume, might easily be produced by forming a small blister air-bubble, or other double spot, in the glass or metal of which the cover is made. No dew would form on this spot, at least till long after it had begun on the adjacent surface. Another objection is, that the air immediately round the spot where the deposition occurs is strongly impregnated with ether, which may possibly have some effect on the commencement of deposition, especially at temperatures and pressures beyond the range of these experiments, and where the dew-points are much farther below the temperature of the air.

Pouillet's hygrometer.

M. Pouillet has produced a different substitute for Mr Daniell's hygrometer. The stem of a thermometer descends through, is closely fitted into, and secured in, a perforation in the bottom of a small silver cup; the bulb only of the thermometer being left above within the cup. When this instrument is to be used, ether is poured into the cup till it cover the bulb, and the consequent evaporation producing cold, causes a deposition of dew in the form of a narrow ring on the outside of the cup, and on a level with the surface of the ether. But owing to the whole bulb of the thermometer not being exposed to so great a cold as that at the surface of the ether, and which causes the deposition of dew, we should suspect this contrivance of being liable to give the dew-point too high, though not perhaps to the same extent as Mr Daniell's. There is likewise reason to think that the cup, if deep, would retard the evaporation, while, if shallow, it could not prevent the wind from blowing the ether over its sides. But perhaps both these inconveniences might be avoided by having a bit of muslin stretched close over the surface of the ether, and as if swimming in it; though this again, by retarding the circulation of the ether in the cup, might tend to augment the error in the indication of the thermometer.

Proposed construction.

We have sometimes thought that a construction combining the advantages, and avoiding the defects, of these several contrivances, might be obtained, without departing so far from the form of Mr Daniell's instrument. Thus, if the uncovered bulb *b*, which contains the ether in his hygrometer, had a blister or air-bubble formed in the glass, the exterior surface of this would remain dry or free from dew, at least till the cold went far below the dew-point; so that, without running any risk of obliterating the contrast between the clear and bedewed parts of the bulb, we might agitate the instrument sufficiently to ensure that the thermometer within should indicate the temperature of the bedewed surface. When the exterior bulb is of metal, it would be equally easy to make a small part of its side double for the same purpose. There would then be no need for bending the tube, to keep the re-condensed ether from running down and cooling the upper half of the exterior bulb, if indeed that was the design of bending it; for Mr Daniell assigns no reason either for bending the tube or having it so very long. But it is evident, that by keeping the tube straight and much shorter, the instrument would be greatly simplified, and rendered much less liable to accidents. In this form, too, it could be as readily suspended perpendicularly as before, by merely slipping the tube into the forked end of a branch proceeding from the top of the pillar. Perhaps it may be said that the design of the tube's being so long was to keep the ethereal vapour at a distance from the spot where dew is to be deposited; but this, if intended, is effectually defeated by the bending of the tube, which brings the bulbs as near each other as if the covered one were only a little above the stem of the enclosed thermometer. Whether any chemical action may take place between the aqueous and ethereal vapours, which could sensibly affect the deposition of dew, we could not pretend to say; but it is natural to think that the expansive force of the ethereal vapour should distend or dilate the air and moisture, which would tend to lower the dew-point. Mr Adie's experiments, it is true, seem to give the dew-point the same as by Leroy's method; but in his cases given above, the dew-point is generally so little below the temperature of the air as to have required very little ether to produce the requisite cooling; so that it may have been owing to the comparatively feeble state of the ethereal vapour that the dew-point was not sensibly affected; or possibly the chemical and mechanical effects of the ether on the dew-point might be opposed to each other. But it is surely more safe to avoid any risk of this sort altogether. With any sort of dew-point instrument, it must be difficult to observe at low temperatures the precise degree at which the vapour is cooled to saturation, owing to its extreme tenuity. For unless the bright surface be sensibly colder than the air to which it is presented, the commencement of deposition is not likely to be readily noticed in very attenuated vapour.

Hutton's hygrometer.

Dr James Hutton seems to have been the first who thought of applying the comparison of the different indications which a thermometer exhibits in a dry and in a moistened state to the purposes of hygrometry. With this view he had a thermometer enclosed in a glass tube hermetically sealed, which he first held in a proper situation till it acquired and showed the temperature of the air. Then having dipped it in water, he held the end of the tube which contained the bulb towards the current of air, and observing how much the thermometer had been lowered by evaporation, he regarded the depression as a measure of the dryness of the air. This view of the matter, though not quite correct, was a wonderful step, considering how little was then known regarding the laws which regulate the diffusion of aqueous vapour in air or other elastic fluids. But instead of employing only one thermometer, and enclosing it, as Dr Hutton did, in a glass tube, it is found not only more convenient, but conducing to greater accuracy, to use two thermometers; one of which notes the actual temperature of the air, while the other, having its bulb covered with muslin, silk, cambric, or the like, and moistened with pure water, shows the temperature as depressed by evaporation. We have found it to be still more convenient to have both thermometers mounted on one broad and doubly graduated scale, and both might be of the self-registering sort. Soft paper has sometimes been used to cover the thermometer; but if it contain any soluble matter, it is apt to render the water impure, and vitiate the results. In short, whatever sort of covering is used, care should be taken to have it both clean and free from every thing which may affect the purity of the water. Thus the thermometer is found to be much less cooled by evaporation when moistened with brackish water than with fresh. Some cover the bulbs of both thermometers, with the view of having the surfaces as nearly alike as possible, and of one colour, to obviate any unequal effects of light or radiation; the nearer to white of course the better.

This sort of hygrometer, after having been sadly neglected for thirty years, at least in any thing near its original form,[1] has at length become an object of interest both here and on the Continent, particularly in Germany, where it has been dignified with the name of the *Psychrometer*. The British Association too has repeatedly expressed a desire to receive a satisfactory exposition of the theory of this instrument, and has requested observers to institute comparative experiments between its indications and the corresponding dew-points, as obtained by the methods already described. So that, when once comparisons of this sort have been made in circumstances sufficiently varied for the different states of the air, this hygrometer, from the durability and simplicity of its construction, the extreme facility with which it can be used, and the consistency of its indications in like states of the air, bids fair to come into more general use than any other; and this, we should think, is likely to be the case in a very few years. One of its most remarkable features, and which adds greatly to its value, is, that its indications are scarcely affected by any ordinary wind. They are, however, as will be noticed after, somewhat under the influence of the atmospheric pressure, but so slightly, that at the same place variations of pressure may in ordinary cases be neglected. When the moist thermometer is below 32°, about an eighth part of its depression below the temperature of the air is owing to the expense of heat for liquefying the ice previously to evaporation; the heat of liquidity being about a seventh part of the latent heat of the vapour; but this is a point which, so far as we know, has not yet been examined by any direct experiments.

When this instrument is first exposed to the drying influence of air, in which the aqueous vapour is not already in a state of saturation, evaporation takes place, and lowers the temperature of the moist bulb, by abstracting heat from it for the formation of additional vapour; but a limit is soon set to the fall of temperature by the surrounding air, which, in successively touching the wet and colder surface, imparts heat to it; and also no doubt by the warmer surrounding bodies throwing in a little heat upon the colder bulb by radiation. The heat thus imparted and thrown in is next to all we can think of as being continually supplied to the moist surface, and spent in the formation of new vapour, the supply being of course exactly equal to the expenditure, which depends on the drying influence of the air; and so does the difference of temperature, though the precise relations between them have not yet been determined. It might indeed be supposed that the stem of the thermometer should convey a little heat to the moist bulb; but the stem being of glass, is a bad conductor, and any heat which it supplies must be very inconsiderable, since it makes no sensible difference whether we apply a wet covering to the bulb alone, or continue it along a part of the stem. However, in the *Edinburgh Encyclopædia*, art. HYGROMETRY, Dr Anderson advances the doctrine, that the moist bulb itself furnishes all the heat spent in the formation of new vapour; whereas we cannot conceive how it can continue to furnish the smallest portion of heat after the process has fairly commenced, any more than a hot iron could continue to furnish heat to the air after it has been cooled down to the temperature of the air. Dr Anderson has, in the same article, and afterwards in different volumes of the *Edinburgh Phil. Jour.* (first series), given a variety of investigations connected with the use of the moist-bulb hygrometer; but as they involve the idea that the capacity of air for moisture is, *cæteris paribus*, proportional to the barometric pressure, his results necessarily diverge widely from the truth, when applied to cases materially different from those on which they are founded.

As already mentioned, the extent of the depression of temperature is scarcely affected by any ordinary wind; but unless the heat which surrounding bodies throw in

[1] A description of the late Sir John Leslie's hygrometer will be found under the article METEOROLOGY

by radiation on the colder bulb be quite inappreciable, this constancy of depression, so far from proving that the cooling influence of evaporation is independent of the wind, would rather argue that it is less as the velocity of the wind is greater. For since evaporation increases with the wind, while radiation is believed to be independent of it, it follows that the heat supplied by radiation not increasing in the same ratio as the expenditure or new vapour does, the depression, in place of being constant, as it is found to be, ought to increase with the velocity of the wind. Hence either the heat supplied by radiation is inconsiderable, or, which is more probable, the cooling influence of evaporation is less as the velocity of the wind is greater. From experiments described by Mr Meikle in the *Edinburgh Phil. Jour.* for January 1827, it appears that giving a pretty rapid motion to a moist thermometer in air confined over sulphuric acid, tended considerably to increase the depression of temperature; but it may be questioned whether this was not owing to the agitation of the apparatus enabling the acid to render the air drier.

Philosophers are by no means agreed regarding the theory of this instrument, which, as we shall afterwards see, is involved in great difficulty and obscurity; but this is of less consequence, since a complete theory does not seem necessary to enable us to apply it to hygrometric purposes. For when once the dew-points corresponding to a sufficient variety of indications of the wet and dry thermometers and of the barometer have been well ascertained, a table of dew-points may be constructed from them, having for its entries or arguments the indications of the wet and dry thermometers, corrected, if necessary, for the particular pressure; so that, when aided by such a table, the indications of the wet and dry thermometers, and of the barometer, may obviously give us the dew-point, whether we know any thing of the theory or not.

The results of experiments determining the dew-point for a considerable number of indications of the wet and dry thermometers, and under various pressures, though principally at pretty high temperatures, are given in a Calcutta journal, *Gleanings in Science*, Nos. II. and III. 1829, and in the *Edinburgh Phil. Jour.* for October 1833, from which we have obtained the following table. The sixth column is derived from the formula

$$f_{t'} - \frac{(f_t + \cdot 66372)(t - t')}{175\cdot 438 f_t} = f_{t''},$$

where t is the Fahrenheit temperature of the air, t' that of the moist bulb, and t'' the dew-point; and f_t, f_{t}', f_{t}'' are the forces of aqueous vapour in a state of saturation at these temperatures respectively.

Barometer.	Temperature of the Air.	Temperature of Moist Bulb.	Difference or Depression.	Observed Dew-point.	Computed Dew-point.	Difference.	Remarks.
29·75	67°·2	52°·0	15°·2	35°·7	35°·7	0	
30·025	56·4	49·5	6·9	39·5	40·7	+ 1·2	Dr Anderson's experiments.
29·35	65·0	51·5	13·5	35·45	36·6	+ 1·1	
29.787	82·0	76·8	5·2	74·0	75·0	+ 1·	Observations made in India at the level of the sea by means of Leslie's and Daniell's hygrometers.
29·83	81·0	72·1	8·9	68·0	68·6	+ 0·6	
29·78	81·5	70·9	10·6	66·5	66·5	0	
29·8	74·75	67·3	7·45	63·0	63·6	+ 0·6	
28·739	91·5	69·2	22·3	60·5	60·1	— 0·4	Do. on hills in the south of India.
28·739	91·5	70·7	20·8	62·5	62·7	+ 0·2	
28·807	87·5	71·48	16·02	64·0	65·4	+ 1·4	
24·342	70·25	60·0	10·25	54·0	53·6	— 0·4	
22·945	61·75	54·37	7·38	48·0	47·98	— 0·02	
22·921	63·0	53·46	9·54	46·0	45·3	— 0·7	
22·917	61·75	46·09	15·66	26·5	25·0	— 1·5	
22·909	57·75	47·75	10·0	36·0	35·7	— 0·3	

The dew-points in the sixth column do not differ very materially from observation; but the temperatures from which they were computed had first to be corrected for the barometric pressure, being different from thirty inches. The precise rule for estimating such a correction is as yet unknown; but it appears that, for the same temperature of the moist bulb, the difference between it and the dry thermometer, when the pressure amounts to thirty inches, is to their difference under any other pressure B, nearly in the inverse ratio of 57 to 27 + B. On this supposition, $t - t'$, the observed depression in the fourth column, before being used in the formula, has been multiplied by $\frac{27 + B}{57}$; and the difference between the product and $t - t'$ has likewise been applied, with its sign changed, as a correction to t, the temperature of the air. Although the temperature of the moist bulb is the one which is more immediately affected by pressure, it is considered easier to compute a tolerable correction to be applied to the other thermometer, so as still to lead to the same result. Some account of experiments relating to this will be found under the article EVAPORATION; though, perhaps, owing to the greater dryness and small volume of air operated on, the effect of pressure in most of the experiments there described seems to be greater than in the open air.

A considerable number of experiments on the dew-points corresponding to the indications of the moist and dry thermometers, though only between the temperatures of 69°·5 and 56°·25, are given in the *Edinburgh Phil. Jour.* for October 1834; but being made under the ordinary pressure, they throw no light on the effects of different pressures; and, considering how little the dew-points go below the temperature of the air, these experiments can scarcely be said to agree so well, either among themselves or with the formula, as the other 15 given above. The author supposes the discrepancies to be owing to the uncertainty attending the use of Daniell's hygrometer, with which they had been observed.

By means of the preceding formula for expressing the relations between the temperatures t, t', t'', the same ingenious author has computed the following table of dew-points, which, however, we have arranged in a more compact form, and curtailed considerably. For since it seems better to leave extreme cases, and such as are of rare occurrence, to be computed by some formula, than to swell out the tables to embrace them, we have omitted all that part of the table which went above the temperature of 100°; and really wish we had been possessed of data to have authorized its extension downward, if possible, to the zero of Fahrenheit. The argument or entry on the left-hand side is the temperature of the air, while the excess of that over the temperature of the moist bulb is the argument on the top. But if at the time of observation the barometer has differed from thirty inches, these arguments should first be corrected by means of the small table in the lower right-hand corner, which is to be entered at the bottom with the barometric pressure, and on the right side with the observed difference between the wet and dry thermometers. The number thus obtained from this small table is to be subtracted from both the arguments of the large table when the pressure falls short of thirty inches, and added when it is greater.

Table of Dew-Points.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
98·8	97·7	96·6	95·4	94·2	93·0	91·8	90·6	89·4	88·1	86·8	85·5	84·2	82·9	81·6	80·3	78·9	77·5	76·1	74·7	73·2	71·7	70·2	68·6	67·0	65·4	63·7	61·9	60·1	58·3
97·8	96·7	95·5	94·3	93·1	91·9	90·7	89·5	88·3	87·0	85·7	84·4	83·1	81·8	80·5	79·2	77·8	76·4	75·0	73·5	72·0	70·5	68·9	67·3	66·7	64·0	62·3	60·5	58·6	56·7
96·8	95·7	94·5	93·3	92·1	90·9	89·7	88·5	87·2	85·9	84·6	83·3	82·0	80·7	79·4	78·0	76·6	75·2	73·7	72·2	70·7	69·2	67·6	66·0	64·3	62·6	60·8	59·0	57·1	55·1
95·8	94·6	93·4	92·2	91·0	89·8	88·6	87·4	86·1	84·8	83·5	82·2	80·9	79·6	78·2	76·8	75·4	74·0	72·5	71·0	69·5	67·9	66·3	64·6	62·9	61·2	59·4	57·5	55·4	53·5
94·8	93·6	92·4	91·2	90·0	88·8	87·6	86·3	85·1	83·8	82·5	81·2	79·8	78·4	77·1	75·7	74·3	72·8	71·3	69·8	68·2	66·6	64·9	63·2	61·5	59·7	57·8	55·9	54·0	51·9
93·8	92·6	91·4	90·2	89·0	87·8	86·5	85·3	84·0	82·7	81·4	80·1	78·7	77·3	75·9	74·5	73·0	71·5	70·0	68·5	66·9	65·3	63·6	61·9	60·1	58·3	56·4	54·4	52·3	
92·8	91·6	90·4	89·2	88·0	86·7	85·5	84·2	82·9	81·6	80·3	78·9	77·5	76·1	74·7	73·3	71·8	70·3	68·8	67·2	65·6	63·9	62·2	60·4	58·6	56·7	54·7	52·7	50·5	
91·8	90·6	89·4	88·2	87·0	85·7	84·4	83·1	81·8	80·5	79·2	77·8	76·4	75·0	73·6	72·1	70·6	69·1	67·5	65·9	64·2	62·5	60·8	59·0	57·1	55·2	53·2	51·0	48·8	
90·8	89·8	88·4	87·2	85·9	84·6	83·3	82·0	80·7	79·4	78·0	76·6	75·2	73·8	72·4	70·9	69·4	67·8	66·2	64·6	62·9	61·2	59·4	57·5	55·6	53·6	51·5	49·3		
89·7	88·5	87·3	86·1	84·9	83·6	82·3	81·0	79·7	78·3	76·9	75·5	74·1	72·7	71·2	69·7	68·1	66·5	64·9	63·2	61·5	59·7	57·9	56·0	54·0	52·0	49·8	47·5		
88·7	87·5	86·3	85·1	83·8	82·5	81·2	79·9	78·6	77·2	75·8	74·4	73·0	71·5	70·0	68·4	66·8	65·2	63·6	61·9	60·1	58·3	56·4	54·4	52·4	50·3	48·0	45·6		
87·7	86·5	85·3	84·0	82·7	81·4	80·1	78·8	77·4	76·0	74·6	73·2	71·8	70·3	68·8	67·2	65·6	63·9	62·2	60·5	58·7	56·9	54·9	52·9	50·8	48·5	46·2			
86·7	85·5	84·3	83·0	81·7	80·4	79·1	77·7	76·3	74·9	73·5	72·1	70·6	69·1	67·5	65·9	64·3	62·6	60·9	59·1	57·2	55·3	53·3	51·2	49·0	46·7	44·3			
85·7	84·5	83·2	81·9	80·6	79·3	78·0	76·6	75·2	73·8	72·4	70·9	69·4	67·9	66·3	64·7	63·0	61·3	59·5	57·7	55·8	53·8	51·7	49·6	47·3	44·9	42·4			
84·7	83·5	82·2	80·9	79·6	78·2	76·9	75·5	74·1	72·7	71·2	69·7	68·2	66·6	65·0	63·3	61·6	59·9	58·1	56·2	54·2	52·2	50·1	47·8	45·5	43 0				
83·7	82·4	81·1	79·8	78·5	77·2	75·8	74·4	73·0	71·5	70·0	68·5	67·0	65·4	63·7	62·0	60·3	58·5	56·6	54·7	52·7	50·6	48·4	46·1	43·6	41·0				
82·7	81·4	80·1	78·8	77·5	76·1	74·7	73·3	71·8	70·4	68·9	67·3	65·7	64·1	62·4	60·7	59·0	57·1	55·2	53·2	51·1	48·9	46·6	44·2	41·6	38·9				
81·7	80·4	79·1	77·8	76·4	75·0	73·6	72·2	70·7	69·2	67·7	66·1	64·5	62·8	61·1	59·4	57·5	55·6	53·7	51·6	49·5	47·2	44·8	42·3	39·6					
80·7	79·4	78·1	76·7	75·3	73·9	72·5	71·0	69·6	68·1	66·5	64·9	63·2	61·5	59·8	58·0	56·1	54·2	52·1	50·0	47·8	45·4	43·0	40·3	37·4					
79·7	78·3	77·0	75·6	74·2	72·8	71·4	70·0	68·4	66·9	65·3	63·7	62·0	60·3	58·5	56·6	54·7	52·7	50 6	48·4	46·1	43·6	41·0	38·2	35·2					
78·6	77·3	76·0	74·6	73·2	71·7	70·3	68·8	67·2	65·7	64·1	62·4	60·7	58·9	57 1	55·2	53·2	51·1	49·0	46·7	44·3	41·7	39·0	36·0						
77·6	76·3	75·0	73·5	72·1	70·7	69·2	67·6	66·1	64·5	62·8	61·1	59·4	57·6	55·7	53·7	51·7	49·6	47·3	45·0	42·4	39·7	36·8	33·7						
76·6	75·3	73·9	72·5	71·0	69·5	68·0	66·5	65·0	63·3	61·6	59·8	58·1	56·2	54·2	52·2	50·1	48·0	45·6	43·1	40·4	37·6	34·6	31·2						
75·6	74·2	72·8	71·4	69·9	68·4	66·9	65·3	63·7	62·1	60·3	58·5	56·7	54·8	52·8	50·7	48·5	46·2	43·8	41·2	38·4	35·4	32·2							
74·6	73·2	71·8	70·3	68·9	67·3	65·8	64·2	62·5	60·8	59·1	57·2	55·3	53·4	51·3	49·2	46·9	44·5	42·0	39·2	36·3	33·1	29·7							
73·6	72·2	70·7	69·2	67·7	66·2	64·6	63·0	61·3	59·5	57·7	55·9	54·0	52·0	49·8	47·6	45·2	42·7	40·1	37·2	34·1	30·7	27·0							
72·6	71·1	69·7	68·2	66·6	65·1	63·4	61·8	60·1	58·3	56·4	54·5	52·5	50·4	48·2	46·0	43·5	40·8	38·1	35·0	31·7	28·1								
71·5	70·1	68·6	67·1	65·6	64·0	62·3	60·6	58·8	57·0	55·1	53·1	51·1	49·0	46·6	44·2	41·6	39·0	36·0	32·8	29·2	25·3								
70·5	69·1	67·5	66·0	64·4	62·8	61·1	59·3	57·5	55·7	53·7	51·7	49·6	47·3	45·0	42·5	39·8	36·9	33·8	30·4	26·5	22·3								
69·5	68·0	66·5	64·9	63·3	61·6	59·9	58·1	56·2	54·4	52·4	50·3	48·1	45·7	43·3	40·6	37·8	34·8	31·4	27·8	23·7									
68·5	67·0	65·4	63·8	62·2	60·5	58·7	56·9	55·0	53·0	51·0	48·8	46·5	44·1	41·5	38·7	35·8	32·5	29·0	25 0	20·5									
67·4	66·0	64·3	62·7	61·0	59·3	57·5	55·6	53·7	51·6	49·5	47·3	44·9	42·4	39·7	36·8	33·6	30·2	26·3	22·0	17·1									
66·4	64·9	63·2	61·6	59·9	58·1	56·3	54·3	52·3	50·2	48·0	45·7	43·2	40·5	37·8	34·7	31·4	27·7	23·5	18·8										
65·4	63·8	62·2	60·5	58·7	56·9	55·0	53·0	51·0	48·8	46·5	44·1	41·5	38·8	35·8	32·5	29·0	25·0	20·4	15·1										
64·4	62·7	61·1	59·3	57·5	55·7	53·7	51·7	49·6	47·3	45·0	42·4	39·7	36·8	33·7	30·2	26·4	22·1	17·0											
63·3	61·7	60·0	58·2	56·4	54·5	52·5	50·4	48·2	45·8	43·4	40·7	37·9	34·8	31·5	27·8	23·6	18·8	13·2											
62·3	60·6	58·9	57·1	55·2	53·2	51·2	49 0	46·7	44·3	41·7	39·0	36·0	32·7	29·2	25·2	20·6	15·3												
61·3	59·6	57·8	55·8	54·0	52·0	49·8	47·6	45·1	42·7	40·1	37·1	34·0	30·5	27·6	22·3	17·3	11·4												
60·3	58·5	56·7	54·8	52·8	50·7	48·5	46·2	43 7	41·1	38·3	35·2	31·9	28·2	24·0	19·3	13·7													
59·2	57·4	55·5	53·6	51·5	49·4	47·1	44·7	42·2	39·4	36·4	33·2	29·7	25·7	21·2	15·9	9·6													
58·2	56·3	54·4	52·4	50·3	48·1	45·7	43·2	40·6	37·7	34·6	31·1	27·3	23·0	18·1	12·2														
57·2	55·3	53·3	51·2	49·1	46·8	44·3	41·7	39·0	35·9	32·6	28·9	24·8	20·1	14·6	7·9														
56·1	54·2	52·2	50·0	47·8	45·4	42·9	40·1	37·2	34·0	30·5	26·6	22·1	17·0	10·8															
55·1	53·1	51·0	48·8	46·5	44·0	41·4	38·5	35·5	32·1	28·3	24·1	19·2	13·5	6·4															
54·0	52·0	49·8	47·6	45·2	42·6	39·8	36·8	33·6	30·0	26·0	21·4	16·1	9·5																
53·0	50·8	48·6	46·3	43·8	41·1	38·2	35·1	31·8	27·8	23·4	18·4	12·4	4·9																
51·9	49·7	47·5	45·0	42·4	39·6	36·6	33·3	29·7	25·6	20·8	15·3	8·5	—0·2																
50·9	48·6	46·2	43·8	41·1	38·1	34·8	31·3	27·4	23·0	17·8	11·5	3·7																	
49·8	47·5	45·1	42·4	39·6	36·6	33·2	29·7	25·3	20·5	14·8	7·8	—1·4																	
48·8	46·4	43·8	41·1	38·2	35·0	31·4	27·4	22·9	17·7	11·3	3.3																		
47·7	45·2	42·6	39·7	36·6	33·3	29·5	25·3	20·4	14·7	7·4	—2·0																		
46·6	44·1	41·3	38·4	35·1	31·6	27·5	23·0	17 7	11·2	2·9																			
45·5	42·9	40·0	37·0	33·5	29·7	25·5	20·6	14·7	7·3	—2·4																			
44·4	41·7	33·7	35·5	31·9	27·9	23·3	17·9	11·4	3·1																				
43·4	40·5	37·4	34·0	30·1	25·7	20·8	14·8	7·4	—2·6																				
42·2	39·3	36·1	32·5	28·4	23·9	18·5	12·0	3·6																					
41·1	38·1	34·7	30·9	26·2	21·7	15·8	8·5	—1·2																					
40·1	36·8	33·2	29·3	24·7	19·4	12·9	4·6	—7·0																					
38·9	35·6	31·8	27·6	22·7	16·9	9·7	0·2																						
37·8	34·3	30·3	25·8	20·6	14·3	6·2	— 5·0																						
36·7	33·0	28·8	0	18·1	11·4	2·2	—11·5																						

	20	21	22	23	24	25	26	27	28	29	29·2	29·4	29·6	29·8
30										·72	·57	·43	·29	·14
29										·69				
28									1·34	·67				
27									1·30	·65				
26								1·87	1·25	·62				
25								1·79	1·20	·60	·47	·36	·24	·12
24							2·31	1·73	1·15	·57				
23							2·22	1·65	1·10	·55				
22						2·64	2·12	1·58	1·05	·53				
21						2·52	2·03	1·51	1 01	·50				
20					2·88	2·40	1·93	1·44	·96	·48	·38	·29	·19	·09
19					2·73	2·28	1·83	1·37	·91	·45				
18				3·02	2·59	2·16	1·74	1·30	·86	·43				
17				2·85	2·45	2·04	1·63	1·22	·82	·41				
16			3·07	2·69	2·30	1·92	1·54	1·15	·77	·38				
15			2·88	2·52	2·16	1·80	1·44	1·08	·72	·36	·28	·21	·14	·07
14		3·02	2·69	2·35	2·01	1·68	1·34	1·01	·67	·33				
13		2·81	2·50	2·18	1·87	1·56	1·25	·94	·62	·31				
12	2·88	2·59	2·30	2·02	1·73	1·44	1·15	·86	·57	·29				
11	2·64	2·38	2·11	1·85	1·58	1·32	1·06	·79	·53	·26				
10	2·40	2·16	1·92	1·68	1·44	1·20	·96	·72	·48	·24	·19	·14	·09	·05
9	2·16	1·94	1·73	1·51	1·29	1·08	·86	·65	·43	·21				
8	1·92	1·73	1 54	1·34	1·15	·96	·77	·57	·38	·19				
7	1·68	1·51	1·34	1·18	1·01	·84	·67	·50	·33	·17				
6	1·44	1·30	1·15	1·01	·86	·72	·57	·43	·29	·14				
5	1·20	1·08	·96	·84	·72	·60	·48	·36	·24	·12	·09	·07	·05	·02
4	·96	·86	·77	·67	·57	·48	·38	·29	·19	·09				
3	·72	·65	·57	·50	·43	·36	·29	·19	·14	·07				
2	·48	·43	·38	·33	·29	·24	·19	·14	·09	·05				
1	·24	·21	·18	·17	·14	·12	·09	·07	·05	·02				
									32	31	30·8	30·6	30·4	30·2

Hygrometry. Hygrometric scales.

A different mode of obtaining from the same data, not only the dew-point, but likewise the force, weight, &c. of moisture in the air, has been proposed by Mr Meikle, in the *Edinburgh Phil. Jour.* for July 1834 and April 1835, to consist of certain graduated lines or scales delineated on a plane, and are to be used by laying over it any thing most convenient which will form a straight line, such as a common ruler, a thread stretched, &c. This sort of scheme is not deduced from theory, but merely from observation, and seems to admit of being varied very considerably in its form; though it is likely that, when more numerous and certain data have been obtained, some particular modification will be found to have the advantage of the rest. For we are not aware of any accurate experiments having yet been made on the moist-bulb hygrometer at low temperatures. Plate CCXCVI. shows one of the various forms proposed for this purpose in the articles just cited, though it is not here followed up in every particular. The mode of using it will be pretty evident from inspection. If a straight line or ruler be applied to the temperature of the air on the left-hand curve, and at the same time to the temperature of the moist bulb on the oblique straight line, it will both mark the dew-point on the scale so named on the right, and at the same time show on the other scale, a little farther to the right, the weight of moisture actually diffused in a cubic foot of the surrounding air, in grains and tenths of a grain. The like degrees of temperature on the different scales are everywhere disposed in a horizontal straight line. If otherwise arranged, these scales could not be used by simply laying a straight line over them, as is evident if we take a case in which the vapour approaches saturation. The oblique straight line is an asymptote to the two curves nearest it, which are meant for hyperbolas; but the divisions for degrees of temperature decrease a little downward in the lower part of the figure. It has been objected, that the hyperbolas would not suit air absolutely dry, and a dew-point infinitely low; but it is shown at length in the *Edinburgh Phil. Jour.* for April 1835, that no such case can ever occur in using the moist bulb, and that this scheme is not restricted to hyperbolas. The results obtained by this method sometimes differ considerably at low temperatures from those of the large table of dew-points; but we know of no experiments to decide how far any of them may be right at low temperatures.

We have thought it better at present not to encumber the diagram with what was originally proposed in this scheme as a correction for pressure, because there seems still to be some uncertainty regarding the precise allowance. But when the barometer differs from thirty inches, the approximate correction, which was already noticed above, may be employed here. It is equivalent to using $t' + \frac{B + 27}{57} \times (t - t')$ in place of the actual temperature of the air. The force of vapour corresponding to a known dew-point is sufficiently well ascertained for ordinary purposes; but we have likewise at present omitted the scale proposed for it, in order not to render the scheme too complicated at its first outset. The same allowance for frost will of course be required here as in any other method with the moist-bulb hygrometer.

Were this project fully realized, that is, if by merely laying a ruler across the plate in the manner above mentioned, the dew-point and weight, &c. of the vapour in the air could be indicated at once, and without computation, it would obviously be one of the most convenient methods yet employed for the purpose.

Theory of the moist bulb hygrometer.

We shall now endeavour briefly to sketch out a few steps towards an investigation of the relation between the dew-point and the corresponding indications of the moist-bulb hygrometer, and have to regret that the present imperfect state of the data does not warrant or enable us to render it more complete. It was shown above, that the value of any particular degree on Fahrenheit's scale of an air-thermometer, that is, the increment or decrement of heat necessary to produce a change of one degree by Fahrenheit's scale, in the temperature of a given mass of air under a constant pressure, will be inversely as the distance of that degree from $-448°$. But when the volume and pressure are both constant, with a variable mass, the increment, decrement, or specific heat for one degree of Fahrenheit, will, so far as depends on change of temperature, be inversely as the square of the distance of that degree from $-448°$, viz. in the ratio compounded of the mass or density of the air and the value of a degree, each of which varies inversely as the temperature reckoned from -448. For we have likewise shown above, that the specific heat of a given volume of air is, *cæteris paribus*, as its density. Strictly speaking, it is obviously the fluxion of the heat which varies in this manner. Hence, so far as depends on change of temperature, the fluxion of the quantity of heat in a cubic foot of air cooling under a constant pressure at the temperature t, will be directly as $-dt$, and inversely as $(t + 448)^2$. It may therefore be denoted by

$$\frac{-A\,dt}{(t + 448)^2}$$

where A is a constant.[1] The fluent of this taken between the temperatures t and t' is

$$\frac{A(t - t')}{(t + 448)\,(t' + 448)},$$

which is the heat lost by the cubic foot of air while its variable mass is cooling under a constant pressure from t to t'. Hence, if the specific heat of a cubic foot of dry air of thirty inches pressure, and confined in an inextensible vessel at 32° F. be reckoned unit, and of course only three fourths of what it would be were the pressure constant, the value of A for the cooling of air under any constant pressure B, must be such that three fourths of it may equal the denominator in the above formula, when $B = 30$ and $(t + 448)\,(t' + 448) = (32 + 448)^2$;

$$\text{so that, } A = \tfrac{4}{3}\,(480)^2 \times \frac{B}{30}.$$

Now, from Dr Haycraft's experiments, it appears that at the same temperature the specific heats of all elastic fluids, and mixtures of them, so far as yet tried, are equal under equal volumes and pressures; and we have shown above, that the specific heat of a cubic foot of air, under a constant pressure, is directly as its density and inversely as its temperature reckoned from $-448°$. Combining these together, it follows that the specific heat of a cubic foot of elastic fluid is directly as the pressure and inversely as the square of the temperature reckoned from $-448°$; so that, at the same temperature, it is as the pressure simply. It will therefore come to the same thing if, in place of taking the sum of the separate specific heats of air, and of the vapour previously in it, we suppose either to have the joint pressure of both, which will equal that of the atmosphere. Consequently, the heat which a cubic foot of air and vapour at the temperature t would impart to the wet and colder surface, while cooling through $t - t'$ degrees, under the constant pressure B, will be

[1] The fluxion of the heat due to the fluxion of the mass, which is the same with the absolute heat in the increment of the mass, is a very different thing, being positive whilst this is negative; nor does it at all pertain to the specific heat.

$$\frac{\frac{4}{3}(t-t')\,(480)^2 \times \frac{B}{30}}{(t+448)\,(t'+448)}.$$

This perhaps would require to be slightly modified, for the mechanical influence of the new vapour which enters into the air during the observation.

Difficulties in the way of solving this problem.

We should have been happy to have completed an investigation of the relation between the dew-point and the indications of the moist-bulb hygrometer; but in endeavouring to prosecute it farther, we were met by difficulties which we suspect have been in a great measure overlooked by those who profess to solve the problem with perfect ease. Thus, if we suppose the depressed temperature to extend unaltered to a certain distance from the moist surface, and then all at once to change into the actual atmospheric temperature, is not this to assume an abrupt transition of temperature having no known parallel in nature, especially where the cooling process proceeds so slowly? We cannot comprehend, for instance, how the moist bulb, at a temperature of 70°, could be surrounded by a shell of air also exactly at 70° throughout its whole thickness, while the air immediately outside of this could be at 90°. Nor is there greater probability that the saturated vapour terminates abruptly, or that both terminate exactly at the same distance. Now, if neither the depressed temperature nor the new vapour terminate abruptly or at the same distance, is there any thing known of the nature of the law according to which either the one or the other decreases in the actual circumstances? Until some light is thrown on questions like these, every thing in the shape of a solution of the problem must rest in a great measure on conjecture; no matter how well successive trials and alterations may bring such an empirical solution apparently to agree with the phenomena. We should think it highly probable that the air enveloping the moist bulb is in a state of continual intermixture similar to that of a fermenting liquor; but how such a state of the air and humidity, if it exist, could be expressed algebraically, we cannot pretend to say.

Theoretical estimate of the latent heat of aqueous vapour.

Another point which, we presume, has not been sufficiently attended to in attempts to solve this problem, is the nature of the latent heat of aqueous vapour, particularly the manner in which it probably varies in different circumstances, and the relation which it bears to its own specific heat and that of air. These we shall now endeavour to examine, in conformity with the foregoing investigation respecting the relations of air to heat, though we can scarcely accomplish this so independently of hypothesis as we did in that case.

When detached from their generating liquids, steam or aqueous vapour, and all elastic fluids yet tried, expand by heat at the same rate as air does, and, like it, observe the law of Boyle, by having the force at the same temperature proportional to the density. But since the second principle above stated regarding the *constancy* in the ratio of the specific heats, or of m to n, seems to be closely connected with the rate of expansion and the law of Boyle, analogy renders it extremely probable that it likewise belongs to all gaseous bodies. Besides, Dr Haycraft's experiments for comparing the specific heats of gases (*Edinburgh Phil. Trans.* vol. x. p. 195, and *Philosoph. Mag.* for September 1824, p. 200) afford a farther presumption in favour of this; for they go far to establish as another general law, that under equal volumes, pressures, and temperatures, all elastic fluids have equal specific heats. His apparatus is incomparably the best which, so far as we know, has been applied to the purpose. That of Delaroche and Berard was so unnecessarily complicated, that we cannot adopt their results. Now, from what we have already quoted from Newton (*Principia*, lib. ii. prop. 23), it readily follows that, if the repulsion between the particles of an elastic fluid vary inversely as any given power of the distance greater than unit, the second principle above mentioned holds respecting that fluid; or its specific heat under a constant pressure exceeds in an *invariable* ratio its specific heat under a constant volume; and that, if such be the case with steam, the rises of true temperature produced in it by compression must at least be proportional to those in air, whether they may be exactly equal to them or not. This, to be sure, is very different from the theory of Clement, to which, we presume, fatal objections have been stated in our article EVAPORATION (vol. ix. pp. 425, 426). But since there is no known instance of any other law of repulsion than the reciprocal of the square of the distance, it is most unlikely that the particles of air alone should observe this, and other gaseous particles different laws.

From such considerations we are led to conclude that steam should have the ratio of its specific heats not only constant (as Laplace and Poisson maintain), but the same as in air, and consequently have its temperature raised at the same rate by compression; and, till something else be shown to the contrary, we shall adopt Mr Watt's opinion, which, we presume, few will be disposed to dispute, that the latent heat of steam is the same with the heat which would be evolved or rendered sensible by compressing steam to the density of water. By means of these as data we shall proceed to compute the latent heat of steam in terms of its own specific heat. It has been usual to express it in terms of the specific heat of an equal weight of water at some low temperature; as, for instance, to reckon it equal to 1000 times the specific heat of water. This quantity there is reason to suspect to be a very different thing from the sum of the successive specific heats of water, according to the common graduation, continued up through a range of 1000°; in other words, the latent heat of steam is probably very different from the quantity of heat which would raise the temperature of an equal weight of water up through a range of 1000° on Fahrenheit's scale, though they are usually assumed to be equal.

In conformity, then, with the principles which have been laid down as above, let the specific heat of steam at 212°, or the quantity of heat which it would be necessary to add to raise its temperature 1° under a constant volume at 212°, be represented by the variation for one degree in the logarithm of the temperature counted from $-448°$ on Fahrenheit's scale of an air thermometer; namely, by $\log.(448+213) - \log.(448+212) = \cdot0006576$. Steam having a pressure of one atmosphere at 212°, is, according to M. Gay-Lussac, 1694 times rarer than water at 32°, and, consequently, about 1626 times rarer than water at 212°. Hence, on the principles now adopted, were such steam suddenly compressed to the density of water, or to the 1626th part of its bulk, it would have its true temperature raised above 212° by a quantity proportional to, and which might be represented by, $\frac{1}{3}\log. 1626$; that is, supposing that the specific heat of steam should, like that of air, bear the same ratio to the heat which is evolved or rendered sensible by compression, that $\cdot0006576$ bears to $\frac{1}{3}\log. 1626$ (because $\frac{m-n}{n} = \frac{1}{3}$); and that the heat thus evolved, and which is to raise the temperature of the steam so much under the reduced volume, is equal to the heat which it would have been necessary to have added to the steam before its volume was reduced at all, in order to raise its temperature as much under that original volume unaltered. For we have seen that the *magnitude* of the volume, if constant, makes no difference on the quantity of heat necessary to raise the temperature of a given mass of air through the same range, and that as little does the *intensity* of the pressure if constant. Now $\frac{1}{3}\log. 1626 = 1\cdot0703735$, in which $\cdot0006576$, the above representa-

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tive of one degree, is contained 1627·7 times; so that 1628° is the latent heat, in terms of the specific heat of the steam itself at 212° under a constant volume. According to MM. Delaroche and Berard, the specific heat of steam, notwithstanding its vastly greater volume, is only ·847 of that of water; but since ·847 refers to steam under a constant pressure, three fourths of it, or ·635, will be the number for steam under a constant volume. Hence the latent heat of steam, in terms of the specific heat of water, should be $1627·7 \times ·635 = 1034°$, which comes very near the usual estimate; but to this we attach little importance, because we see no ground to believe that the specific heat of steam can be so much, if at all, smaller than that of water at the same temperature. Indeed, considering the vague, complicated, and indirect manner in which Delaroche and Berard obtained the number ·847, it is astonishing that other philosophers should ever have adopted it. Were we to suppose the specific heats of steam and water to be equal at 45° (the mean temperature of the water in which Dr Ure condensed the steam in his experiments), the latent heat of steam at 212° would be 1216° in terms of the specific heat of water at 45°, because $\log. (448 + 46) - \log. (448 + 45) = ·00088$, and is contained 1216·3 times in 1·0703735. This, to be sure, rather exceeds the ordinary estimates, which is no great objection to its accuracy; because in the most approved methods hitherto followed for obtaining experimentally the latent heat, there is reason to suspect that some of the steam, in its passage from the boiler or retort, would be so much cooled as to have either attained the liquid form or the state of a cloud before it reached the cold water in which it was to be condensed, a circumstance which would tend to bring out a deficient result, especially if the steam reached the cold water by a horizontal or descending tube, which could not bring back to the boiler any water formed from steam condensed by the way; but it is doubtful if any tube could entirely obviate this, or prevent cloudy vapour from passing over. Besides, the latent heat being generally computed from a slight rise produced by it in the temperature of a large mass of water, it is obvious that a small inaccuracy in measuring such rise may occasion a considerable error in the latent heat; and it has often been alleged that the heat which raises the temperature of water one degree, is far greater than the thousandth part of what would raise it a thousand successive degrees reckoned on the common scale.

But to come nearer our present purpose; since the latent heat of steam, in terms of the specific heat of water, is scarcely a necessary ingredient in the theory of the moist-bulb hygrometer, we shall now compute the latent heat of steam at 32° Fahrenheit, in terms of its own specific heat under a constant volume at that temperature. Steam in a state of saturation at 32° is about 177200 times rarer than water at same temperature, and $\log. (33 + 448) - \log. (32 + 448) = ·0009039$. This, which represents the specific heat, or one degree at 32°, is contained 1935·5 times in $1·74949 = \frac{1}{3} \log. 177200$. Hence the latent heat at 32° is 1935·5. Now, according to the view we have taken of the subject, the latent heat of steam is expressed by the number of times the above numerical value of the specific heat of an equal weight of it at some particular temperature is contained in one third the logarithm of the number of times the steam is rarer than water. But if we wish to express it always in terms of one quantity, as, for instance, in terms of the specific heat of an equal weight of it under a constant volume at 32°, we shall have log. 177200 to log. R. as 1935·5, the latent heat at 32°, to the latent heat of an equal weight of aqueous vapour at a different temperature, and whose rarity, compared with that of water of its own temperature, is R; so that the latent heat, in the terms now specified, will be

$$\frac{1935·5 \log. R}{5·24846} = 368·77 \log. R,$$

which varies as the logarithm of the number of times the steam is rarer than water, as was hinted in the article Evaporation, vol. ix. p. 426. We there noticed, p. 425, an experiment which proves in a very decisive manner, and independently of any thing now stated, that not only the latent, but the total heat in a given mass of steam in a state of saturation must be less at higher temperatures than at lower. Now, both this and the results of our investigation are consistent with, nay afford a very satisfactory reason for, the well-known economy of heat in high-pressure engines; whereas the usually-received theory of Clement, which supposes the latent heat the same at every temperature, is quite incompatible with such economy. Our investigation also leads to a saving of heat in the case of steam used *expansively*, as it is called; but it would here be out of place to go through the computation at length. For some interesting experiments and remarks by Dr Haycraft, on this, which he calls *surcharged* steam, see *Repertory of Patent Inventions*, vol. xii. p. 25.

M. de la Rive's hygrometer.

M. de la Rive some time ago proposed for a hygrometer the following contrivance, which is, in some respects, the counterpart of the one with the moist bulb. A thermometer being dipped in sulphuric acid, and then exposed to the air, absorbs and condenses the aqueous vapour, which, by evolving its latent heat, and imparting it to the acid, raises the temperature of the thermometer. From this increased temperature, and that of the air, M. de la Rive computes the degree of humidity. In this case, the warming effect of the condensed vapour is restrained by the cooling influence of the air and the radiation of surrounding bodies; whereas in the hygrometer with the moist bulb, the cooling effect of evaporation is limited by the warming influence of the air and radiation. But it is only when the vapour is in a state of half saturation, that either the changes of temperature or the effects of radiation are likely to be nearly equal in the two hygrometers. Perhaps, therefore, a careful comparison of the indications of these instruments in other states of the vapour might afford data for estimating how far they are under the influence of radiation, which would tend materially to elucidate their theories.

While the sulphuric-acid hygrometer displays considerable ingenuity, the other instrument is on several accounts so decidedly preferable, that the invention of M. de la Rive is not likely ever to come into general use. Water can more readily be obtained everywhere, and is much more safe and portable, than sulphuric acid. Besides, owing to sulphuric acid freezing at an uncertain or variable temperature, depending on its strength, such an instrument would be apt to give doubtful results at low temperatures. For, whatever be the strength of the acid at first, it will continue to decrease in an uncertain manner on the bulb by gradually absorbing moisture. However, the heat derived from the condensation of the vapour will sometimes be sufficient to keep the acid in a liquid state at a temperature which would freeze it in a close vessel; and whenever it happens that sulphuric acid remains liquid on the bulb of one thermometer, while water is frozen on that of another, a comparison of the two instruments might throw some light on the influence of frost on the temperature of the latter. We presume, therefore, that the most important use likely to be derived from this hygrometer of M. de la Rive, would be to assist in perfecting the theory of the moist-bulb hygrometer; and possibly some other absorbent substances might answer even better for this purpose than sulphuric acid does.

Hygrometer by compression.

Since the quantity of aqueous vapour which can exist in a given volume is independent of the density of the air, it

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is evident that, when the vapour in the air is in a state of half saturation, we may bring it to complete saturation by injecting additional air into a close vessel till the density is doubled, and doing this either so slowly as not sensibly to warm the air, or to wait a little till the temperature settle. If the vessel is large and of a globular shape, a deposition of moisture should be sensibly produced on its inner surface, so soon as the density gets a very little beyond the double; but with a small vessel, a greater increase of density would be required, because in that case the included mass of vapour would be smaller in proportion to the surface. It would on several accounts be preferable that any vessel for this purpose should be formed of metal with two small openings on opposite sides, closed by bits of glass which would become dim by the deposition of dew on their interior surfaces. Whatever might be the proportion of humidity in the air, it would in all cases be in the inverse ratio of that in which the density was to be increased to produce saturation, and so might be readily had from such a manometer or gauge as is usually employed for showing the pressure, only having a direct in place of an inverse graduation. If a thermometer were included in the vessel, it would need to be cased like that of Dr Hutton's hygrometer, to protect it from the pressure, which, by compressing the bulb, might cause it to show a temperature far above the truth.

Statical hygrometer.

A hygrometer depending on the increase of pressure which additional moisture produces in air not thoroughly damp, will be found described under the article METEOROLOGY; but one depending on the effect which humidity has on the specific gravity of the air might be had by suspending two very light air-tight cylinders of equal dimensions and weight, from the arms of a sensible balance. Thus, if the one cylinder were suspended in a jar containing either a little water, to render the air thoroughly damp, or some drying substance, to render it perfectly dry, the difference in the specific gravities of the exterior and included air would produce a corresponding disturbance in the equilibrium; because the more humid the air, it is the lighter under the same pressure and temperature. The jar would of course need to be closed with a lid, leaving only a small opening for the free motion of a thread or wire suspending the cylinder. The opposite cylinder, too, would need to be suspended in some vessel or cage, only so close as to be a protection from the agitation of the wind.

Since the specific gravity of aqueous vapour is to that of dry air as five to eight, it is evident that when the cylinders, which are to be equal in volume and weight, are both suspended in air of the same temperature and pressure, but differing in humidity, any small weight which, being applied to the more buoyant one, would maintain the equilibrium, must be proportional to the difference in the densities of the aqueous vapour surrounding these two opposite cylinders. So that, if the air around the one were made perfectly dry, the requisite counterpoise would just equal three eighths of the weight of as much aqueous vapour as is contained in a volume of air contiguous to the other cylinder, and equal its bulk. This, however, is not meant to apply to fog or cloudy air, nor are we aware that any other hygrometer does apply to fog. But the same result might be had without any counterpoise, by making the arm of the balance show on a graduated arc the disturbance of equilibrium corresponding to such counterpoise. The apparatus now proposed, though it might be somewhat bulky and expensive, would indicate in the most direct manner, and without regard to temperature or pressure, the actual weight of moisture in the air; and might therefore be of great service in trying and verifying other hygrometers, with the view of obtaining the real values of their indications, and perfecting their theories. It would, in short, possess all the properties which Saussure considered essential to a perfect hygrometer.

Having obtained, by means of such an instrument, g the grains of vapour in a cubic foot of air at the temperature t, the actual force of the vapour will be

$$f = \frac{t + 448}{5658{\cdot}81} \times g.$$

This obviously follows, from what was shown above, in giving the rationale of Leroy's mode of finding the dew-point, namely, that

$$\frac{30}{212 + 448} : \frac{f}{t + 448} :: 257{\cdot}2188 : g.$$

Effect of aqueous vapour on barometric measurements.

It was just observed that the density of aqueous vapour is less than that of dry air at the same temperature and pressure, in the ratio of five to eight. Hence, at the same temperature, the specific gravity of a mixture of air and vapour whose tension is f, is to that of dry air under the same pressure p, as $p - {\cdot}375f$ to p; and therefore, in the mensuration of heights, the weight of a column of air and moisture will have an effect upon the barometer which, *cæteris paribus*, will be less than that of an equally long column of the dry air, in the ratio of $p - {\cdot}375f$ to p. So that, in conformity with the usual principles on which heights are measured, if D be the difference in the logarithms of the corrected pressures at the upper and lower stations, p the mean pressure of the intercepted column of air, t its mean temperature, and f the mean force of its vapour, the height in fathoms will be

$$\frac{p}{p - {\cdot}375f} \times \frac{t + 448}{480} \times 10000\,\mathrm{D}.$$

This includes the reduction of the temperature of the air to 32°; because, under the same mean pressure, the weight of the column of dry air at the temperature t is to its weight at 32° as 480° to $t + 448°$, which is the well-known rate of the expansion of air. We do not, however, mean, that this or any formula is applicable, when the air happens to be foggy or cloudy. Nor would it be of any use here to speculate on, or to attempt to employ, any law according to which the quantity of aqueous vapour may be supposed to vary at different heights, in the form of an independent atmosphere; because the wind and other uncertain vicissitudes of weather derange every thing of this sort, as is evident from the dew-point being found to vary at different heights in a manner which cannot be referred to any definite law which it might be supposed to have followed in perfectly still air.

Formula for the specific gravity of a mixture of air and vapour.

From the above investigation, it is evident that under the pressure p the specific gravity of a mixture of air and vapour whose tension is f, will be to that of dry air of thirty inches pressure at same temperature, as $p - {\cdot}375f$ to 30. So that, if the specific gravity of the dry air of thirty inches pressure at 32° F. be unit, the specific gravity of the mixture at any temperature t will be

$$\frac{p - {\cdot}375f}{30} \times \frac{480}{t + 448} = \frac{16p - 6f}{t + 448}.$$

Professor Daniell has given, in the second edition of his *Essays* (p. 177), an extensive table for finding the specific gravity of a mixture of air and vapour, under a pressure of thirty inches, and for facilitating corrections for the effects of vapour and temperature on barometric measurements; but it requires more trouble to apply it to either of these purposes than the preceding formulæ do; and it is curious that Mr Daniell does not seem aware that the method he follows for correcting measurements, even when aided by that large table, is only suited to a column of air and vapour in a state of saturation, and whose mean pressure is exactly thirty inches; though it rarely happens in the mensuration of heights, that the mean pressure of the air and vapour forming the column is so great. Thus, the force of vapour in the third column of his table being expressed in terms of a pressure of thirty inches as the unit, can of course suit no other; yet in an example on page 183, he applies it as if the mean pressure, 28·77 inches, had been the unit; and no doubt, when the pressure is smaller, it will lead to a more considerable error. A similar objection attaches to the weight or density of vapour in his fourth column; and besides, when he applies it as the "increase of density for weight of vapour," he uses the density of vapour corresponding to the dew-point, which is always greater than the actual density, except when the vapour is in a state of saturation. It is this step in Mr Daniell's method which restricts it to thoroughly damp air; whereas the formulæ we have given above are of general application, only they are not suited to foggy or cloudy air, nor are we aware that any other method is.

Depositions of moisture, &c. from the atmosphere.

We shall now examine some of the more remarkable phenomena resulting from or connected with the deposition of aqueous vapour from the atmosphere. The ingenious Dr James Hutton proposed a theory of rain, which many receive as the true explication of it, viz. that rain is produced by the mixing of different masses of moist air having different temperatures. It is well known from experiment, that the variations in the capacity of air, or more properly of space for moisture, proceed in a higher ratio than the corresponding variations of temperature, as reckoned on the common scales, but still more so with reference to the scale which we deduced above; where it is shown necessarily to follow from admitted principles, that air expands in geometrical progression for equal increments of heat (though this, as we have already noticed, is not precisely the same with the scale which Dr Dalton long ago proposed, and afterwards relinquished). Hence, if the space occupied by the mixture of the different masses of air have either the mean temperature of the whole, or one still lower, its capacity for moisture would come short of the mean, and so a deposition of rain, &c. will ensue, if the air has previously been sufficiently moist. There can be no question that this theory is a possible one; but it would be no easy matter to prove that it is the actual and ordinary mode in which rain is produced. In the *Quarterly Journal of Science* for April 1829, Mr Meikle adduces some reasons countenanced by experiments, which seem to render it very probable that clouds, rain, &c. may often be traced to a nearer and more natural source. The Huttonian theory does not readily explain why rain is more commonly preceded or attended with a falling barometer; for it is as easy to conceive mixtures of air occurring whilst the barometer rises, as when it falls; and the like objection attaches to the electrical theory of rain. Indeed, on many occasions electricity is as serviceable to the moderns as the *occult qualities* were to the ancients; for by referring any difficulty to electricity, we can either evade the trouble of solving it, or the mortification of acknowledging our inability to solve it.

But this prognostic of the falling barometer did not long escape notice after the Torricellian experiment had been made;[1] and the explanation then given, and for long after received, was, that the air, from its rarity, was unable to buoy up or support the denser vapours, and so of course down they came. It was not then known, that, at the same temperature and pressure, moist air, especially if transparent, is lighter than dry. Yet the observers of that period certainly inferred, on very probable grounds, that there existed a connection between the concomitant circumstances of decreasing pressure and depositions of rain, &c. from the atmosphere. They are further to be commended in seeking an explanation in a principle which they supposed to be known; because reason and facts are always preferable to hypotheses. We are far from reckoning their statical explanation to have no share in the phenomena; because the denser the air, the more will it retard or obstruct the descent of minute drops of water or particles of snow, &c.; but the suspension of transparent vapour depends on the temperature alone. For it is now well known, as noticed more particularly under the article Evaporation, that the quantity of vapour contained in a given space is independent of the presence or density of any other elastic fluid with which it is not chemically combined; or that the maximum quantity of vapour which can exist in a given space is the same at the same temperature as it would be did that space contain nothing else. Whenever, therefore, the volume of the same mass of air increases, the capacity of that volume for moisture should increase at the same rate, were the temperature to remain the same; but when air dilates from a diminution of pressure, its temperature always falls, if there be no accession of heat from some other source. A fall in the barometer, however, is not necessarily attended with a reduction of temperature near the earth's surface. On the contrary, the temperature there may often be preserved, or even raised (as we shall afterwards explain), by the intermixture of the higher and lower strata, and by the retention of heat, such as had previously escaped upward by radiation from the earth's surface, but which ceases to do so after the sky is obscured by dense clouds. But where none of these extraneous circumstances interfere, the reduction of temperature properly due to dilatation lessens the capacity of the space so cooled for moisture, far more than the enlargement in bulk increases it; so that, generally speaking, if the air be sufficiently moist, a fall in the barometer, or rarefying the air, should tend to produce clouds, rain, &c.

For example, the volume of a given mass of air will increase about a ninetieth part by being raised through a height of a hundred yards; and the capacity of that volume for moisture would increase in the same ratio did

[1] We are aware that some of the first observers are said to have coupled rain with a rising or high barometer; and indeed there are exceptions. When the wind is shifting from west to east, the barometer generally rises, though followed by copious rain; and, on the other hand, when the wind shifts from east to west, the barometer usually falls, though it remains dry. The motion of the barometer is in such cases to a certain extent connected with the earth's diurnal rotation, and is thus accounted for by Mr Meikle, in the *Edinburgh Phil. Jour.* for December 1827, page 108:—"The curvilinear motion of the wind, describing a circle about the earth, in place of always *lowering* the barometer, as many have supposed, ought frequently to *augment* the pressure of the atmosphere, and consequently to *raise* the barometer. At first sight this may seem paradoxical enough, if not thoroughly absurd; but to solve it we have only to consider, that when the wind is from the east, its diurnal motion round the earth's axis is thereby lessened, its centrifugal force will be of course weakened, and so the air will be more at liberty to gravitate or press freely on the earth's surface. Westerly winds, on the contrary, by conspiring with the diurnal motion, increase the centrifugal force, and diminish the pressure."

The influence of centrifugal force on the pressure will likewise afford a satisfactory reason for hills generally measuring higher by the barometer during wind than during a calm; the air being probably accumulated, or the pressure increased, at the bottom of the hill, by the wind describing almost a straight line, or a curve which is convex downward, while the air is dilated or the pressure diminished at the upper station, by the wind describing over the summit a curve which, compared with the other, is very concave downward. But the difference of centrifugal force at the two stations will have little to do with the diurnal rotation, if the wind has the same velocity and direction at both, though the velocity is more likely to be greater at the summit than below. As for the difference of distance from the earth's centre, it is scarcely worth attending to.

the temperature continue the same. But if the temperature lost one degree, the capacity for moisture would be thereby diminished about a thirtieth; and therefore, upon the whole, aqueous vapour in a state of saturation would have about its forty-fifth part condensed into water by being raised a hundred yards, namely, a thirtieth minus a ninetieth. However, for reasons given above, and to be farther illustrated by and by, it is more likely that the temperature of an ascending current of air will often lose 1°·5 F. or even more, by gaining an elevation of a hundred yards, which would lessen the capacity for vapour about one twentieth. Hence, a rise of a hundred yards would condense about a twenty-sixth part of the vapour, viz. the excess of a twentieth over a ninetieth.

Experiment illustrating the theory of rain, &c.

Such at least would be the result, calculating from the foregoing principles; but the following simple experiment affords a more direct proof that sufficient rarefaction will always change common undried air into a cloud. Connect a small glass flask, containing the ordinary air, with the receiver of an air-pump, by means of an intervening stop-cock. Exhaust the receiver with the cock shut; then looking attentively at the flask, open it suddenly into the receiver, by turning the stop-cock, when a momentary mistiness will be perceived in the flask, which is aqueous vapour condensed into a cloud by the cold produced by the rarefaction. The cloud is here formed under peculiar disadvantages, being everywhere surrounded at so short a distance by a warmer surface throwing in heat upon it, and especially by a vitreous surface which is known to radiate powerfully. But a cloud which is visible in so small a volume would be pretty dense on the large scale. We have never tried this experiment without succeeding; but we believe it may fail when the air contains little moisture, if the receiver be not large compared with the flask, or if the connecting stop-cock have a very narrow bore. It is, however, rare for the external air, in a state of free circulation, to contain so little as a third of the total vapour which could exist in it at the actual temperature.

Since both modes of reasoning lead to the same results, we presume enough has now been said to warrant us to conclude, that when air ascends sufficiently in the atmosphere, it must, from being cooled by dilating, constitute a cloud, or, if moist enough, produce rain, &c. For example, if a current of air traverse the ocean till it becomes very moist; and then, if, on arriving at the shore, this current have to rise higher as the land rises, we have at once the reason why rain so frequently commences nearer the sea, and extends thence forward with the wind,—why more elevated situations are more liable to rain,—and why a wind from the land is more rarely attended with rain on its approaching the shore. But there is reason to think that a stream of air which has been gradually elevated by traversing a rising ground, does not always descend again where the surface declines, but, on the contrary, may continue for some time at that height, or, from the upward force it has already acquired, may even rise higher. In this manner it may deposit rain while rolling far above the tranquil plain, as well as when contending with the asperities of the more elevated surface; especially since the humidity, after being condensed, will be borne along with the current, taking some time to force its way down through the air, and the more so as the air is more dense. If the space over which the raining current passes be not saturated with moisture, the air may revaporize a part or the whole of the rain descending in it. This is no doubt the way in which clouds seem suspended in the air, or even at rest in the wind, though, in fact, they may be falling, and changing into transparent vapour, so as to float on unseen in the wind beneath; whilst their place is continually supplied by the successive condensation of other vapour arriving with the current, and which, in its turn, is revaporized or swept away by the wind. Much in the same way clouds are apparently stationed over elevated peaks, or even over large portions of hills; while the fact is, that their particles are moving onward, and others coming in their stead. The apparent motions of clouds may therefore differ so much from the true as to afford a most fallacious measure of the velocity of the wind.

Theory of mountain-caps.

The circumstance of clouds frequenting hills, or apparently moving towards them, will admit of a similar explanation, without the aid of an imaginary force residing in hills for the express purpose of attracting clouds, rain, &c. The notion that mountain-caps, or clouds hovering about the tops of hills, are produced by the cooling influence of the summit, does not appear to be better founded; because such phenomena frequently occur when the air is considerably colder than the surface of the hill, though they may not continue long of very different temperatures. But were the cloud really owing to the colder temperature of the summit, it would not only touch, but be densest next the surface of the hill, wetting it profusely; whereas the cloud is often observed to be several feet, or many yards, clear of the hill, and the surface as dry at least as that of the surrounding country; a clear proof that the hill is not colder than the cloud. A more natural explanation, we presume, is, that the cloud called the mountain-cap is formed in that part of a current of moist air which is sufficiently cooled by the rarefaction attending its sudden increase of elevation in ascending and rolling over the summit; and that this current will regain its transparency so soon as it afterwards passes on to where it either absorbs as much heat, or acquires an increase of pressure sufficient to restore its former temperature. The reason why the cloud is frequently observed to keep clear of the summit for a considerable time, especially during a brisk wind, is, that the centrifugal force due to the curvature of the current over the hill carries it clear of the summit, and the intervening arched space is left to be occupied by comparatively still air, into which the air recently cooled by rarefaction scarcely enters; and by this means the higher temperature of the summit is preserved for some time. In the same way it often happens, that whilst a storm acts with fury on the face of a precipice, a person on the summit only hears the sound, and feels himself as in a calm; the arched current, with its copious load of rain or hail, being carried clear of the summit by the centrifugal force, while the intermediate space is left almost free from wind, hail, or rain. Since caps rarely occur on hills of moderate height, except when the air is pretty moist, they are not unfrequently precursors of rain.

Much in the same way as in the case of the mountain-cap, may the origin of the cloud called the *cumulus* be traced, especially by means of its horizontal base, to the dilatation of air. Such a cloud may be situated partly in an ascending portion of a current of moist air, and partly in a descending portion; or it may sometimes occupy the most elevated part of an arched-like sweep of the current. Whenever the air reaches the requisite elevation, it will become opaque, but will regain its transparency so soon as it descends again sufficiently to have its temperature restored by increase of pressure. The opacity should terminate underneath nearly all at the same level, or in a horizontal plane, if the heat and moisture have been uniformly or proportionally distributed through the air of the current. When the distribution has been unequal, the base will of course be uneven, or may deviate more or less from a horizontal plane. Perhaps some other modifications of clouds might be accounted for on similar principles. We may farther observe, that clouds, when seen in profile, especially the several parts of the cirrus, when changing into cirro-cumulus, generally appear as if leaning forward like shrubs in the direction in which the wind moves; and longer pieces of cloud are commonly lower in the rear than in front.

Gradation of temperature in the atmosphere.

It is evident that moisture which has ascended in the form of transparent vapour, and descended again as rain, snow, &c. must have left its latent heat above. But much heat no doubt moves upward, from its natural propensity to render the atmosphere of one temperature throughout its whole height, and from the tendency of warmer air to rise above the colder. There is therefore good reason for concluding, that air which has just been suddenly elevated and dilated should be thereby reduced to a much lower temperature than what obtains in air which has remained at that elevation for some considerable time, receiving heat from below, from the sun, or other sources. This is both in accordance with direct observation, and with the conclusions at which we arrived when investigating the relations of air to heat. For the entire fall of temperature properly due to dilatation, as expressed by either of the formulæ given above, viz.

$$(\tau + 248)\left[\left(\frac{\varrho}{\varrho'}\right)^{\frac{1}{3}} - 1\right], \text{ or } (\tau + 448)\left[\left(\frac{p}{p'}\right)^{\frac{1}{4}} - 1\right]$$

far exceeds a reduction of one degree for every 100 yards of ascent. In Gay-Lussac's famous ascent, the pressure was reduced in the ratio of ·432 to 1 at a height of 7600 yards, and the temperature fell 72°·54, or from 87°·44 to 14°·9; so that the density was very nearly halved. With these data, the first formula gives $(87{\cdot}44 + 448)\left[\left(\frac{1}{2}\right)^{\frac{1}{3}} - 1\right] = 110^\circ{\cdot}46$ for the fall of temperature; but the second gives about 9° less, or $(535{\cdot}44)\left[({\cdot}432)^{\frac{1}{4}} - 1\right] = 101^\circ{\cdot}35$; and so it ought, because in Gay-Lussac's ascent the cube of the pressure decreased more slowly than in the ratio of the fourth power of the density. However, there is reason to think that when a strong wind runs up a steep acclivity, the temperature would be found to decrease very nearly in such a manner that the cube of the pressure would, as in these formulæ, vary as the fourth power of the density. To make a proper trial of this, it would need to be done on air which is free from any tendency to deposit moisture, as also when the surface of the acclivity is dry, and completely shaded by elevated clouds from the sun and the aspect of a clear sky, in order that the temperature of the air and surface might everywhere correspond. As the wind is more likely to escape past the sides of an elevated peak than go right over its top, an acclivity proper for this purpose would need to be of such an extent that the temperatures and pressures could be observed in parts of the currents where we were sure the air was making no lateral escape. Calculating then from the second formula, it would follow, that when such a current ascends to where the pressure is reduced in the ratio of ·432 to 1, the temperature should fall from 87°·44 to — 13°·91, or 101°·35, which, being greater than 72°·54, shows that, in this case, the density would not be reduced quite to the half.

The experiment already described for producing the cloud in the flask shows that if an equal weight of air in the upper regions did not contain far more heat than in the lower, the sky would be perpetually obscured with clouds. This is further illustrated by the circumstance, that when the atmosphere is much agitated and intermixed to a great height, it becomes obscured above, no doubt from the dilatation rendering the recently ascended air colder there than corresponds to the constituent temperature of the vapour which it had brought along with it, while the air beneath, which has recently descended, being warmed to or above the dew-point of its vapour, by compression becomes quite transparent, though previously it might have been opaque. In such cases the clouds often present a deep-blue colour. However, it is long since Dr Dalton (*Chemical Philosophy*, vol. i. p. 123) proposed the hypothesis that heat was diffused equally, or in the same proportion as the density of the air, throughout the whole height of the atmosphere; in other words, that a given weight of air anywhere in a perpendicular column contained the same quantity of heat. In this he was followed by several eminent philosophers, though it is quite incompatible with the facts now stated, and would, besides, require the temperature to decrease so rapidly with the elevation, that aqueous vapour, by its superior elasticity, would always shoot up through the air to where it would be condensed by the cold into a cloud, keeping the sky perpetually obscured, which is contrary to observation.

Hygrometry.

Dr Dalton's hypothesis.

It has become a common maxim, that dry air is less transparent than moist; the latter of course being free from fog or cloud. If it is meant that mere dryness impairs the transparency, we should be very apt to question such doctrine, though we do not dispute that the atmosphere is less transparent in very droughty weather. The reason of this we presume to be, that much solid matter is then diffused through the atmosphere in the form of dust or smoke, a great part of which, had it been sufficiently moist, would have been too heavy to float in the air; and some of the remainder, had it been more humid, might have assumed the gaseous form, so as to be transparent.

The temperature at the tops of mountains is generally found to be lower than that of air at the same height over the plains; and a probable reason for it is, that mountains, besides having their temperatures reduced by radiation, are apt to be further cooled by and enveloped in recently dilated ascending currents of air rolling over them. But here again it should be remembered, that our knowledge of the temperature at great heights over the plains has for the most part been derived from a few ascents in balloons, undertaken during the day, and only in very serene and mild weather, when there was scarcely any interchange going on between the air of the different strata. Nothing is known of the decrease of temperature over the plains in a coarse winter night. The same remarks apply in a great measure to ascents on very high mountains; so that in all probability the mean decrease of temperature in the atmosphere has hitherto been greatly underrated. Snow-clad mountains are, besides, cooled, particularly in very dry weather, by the evaporation from the snow; and we may remark, by the by, that at the same temperature, dry air is, for the above reason, less efficacious in melting snow than moist. Because the moist air, in place of spending its heat to form vapour, does, in consequence of its touching a colder body, part with a portion of the latent heat of the vapour it already contained, which must greatly aid in liquefying the snow. The melting of snow therefore does not depend solely on the temperature of the wind, but likewise upon its being previously charged with moisture. Besides, when dry air passes over snow on a high mountain, the evaporation, and consequently the reduction of temperature, will be greatly promoted by the diminished pressure which obtains at such heights. This may help to explain why *snow-winds*, as they are called, should be found so intensely cold; for the mere circumstance of wind having passed over a cold mountain is not a sufficient reason why it should be cold after its descent. But we may here observe by the by, that the reason why snow at great elevations is so little affected by the action of the sun's rays, is, that the rarity of the air induces such a tendency to evaporation, that the moisture evaporates just as fast as it melts, and in this way expends by far the greater part of the sun's heat on the formation of vapour. For since the vaporization of water consumes about seven times as much heat as the melting does, it follows that the heat spent in both melting and evaporating an ounce of snow, would melt no less than eight ounces without evaporation.

Decre[ase] of tem[pe]rature [pro]bably [un]derrat[ed].

Hylozoists.

The explanation which we proposed above of the phenomena of clouds seeming stationary in the wind, appears to be applicable to water-spouts. We readily allow that the ascent of the water in them has been long accounted for in a very rational way, which is briefly this: The collision of currents of air from different quarters produces a whirlwind; the air near the axis of rotation is rarefied by the centrifugal force; and the pressure on the spot under this attenuated air is necessarily diminished. Of course, when a whirlwind occurs on the sea, a lake, or a river, the water rises in the axis of rotation, on the same principle as in the common pump. But the rarefied air itself ascends in virtue of its levity. Its place is supplied by the concourse of the heavier adjacent air, which being rarefied in its turn, ascends; and in this manner an upward current of air is produced, which aids the ascent of the water. Thus far the explanation is very satisfactory. The other principal part of the phenomenon, the apparent descent of a dense stem from the clouds, nearly over the spot where the water rises, has been ascribed to electricity. But this we cannot help regarding as an evasion savouring of occult qualities, rather than an explanation. It seems nearly allied to the notion that hills attract clouds. The column which apparently descends from the clouds (for any descent is altogether illusory till water actually fall) may be accounted for in the same way as the mountain-cap, viz. that it is aqueous vapour condensed by the cold due to the rarefaction which is occasioned both by the whirling motion of the air and by its rapid ascent. The more swift the rotation, the greater obviously will be the rarefaction and cold; and of course the lower down in the axis or stem will the condensation of moisture extend. The sound and flashes of light seem to be thunder and lightning in miniature, according to a theory which will presently be explained. In attending to this and other atmospherical phenomena, most people are embarrassed with a preconception which is not easily overcome, namely, that clouds are solids, or something more substantial than the air in which they are formed.

Theory of thunder and lightning.

We have been long of opinion that the usually received theory of thunder and lightning, as well as that of rain, is unnecessarily complicated and far-fetched, and we therefore regard the following as a more natural and simple one. Volta supposed that bodies, while passing into the gaseous form, absorb electricity, which they emit again on being condensed. Several objections have been made to this, particularly by M. Pouillet; but as they rest in a great measure on the assumption that we possess perfect electrometers, and that experiments made with them are free from every source of fallacy, such objections have not, we think, disproved the more probable opinion of Volta, which has been adopted by several eminent philosophers, who maintain that the electricity emitted by the condensation of steam is always positive. Thunder is unknown in the polar regions, and rarely occurs anywhere in cold weather; from which it appears that thunder does not take place in air incapable of containing much moisture, as is farther confirmed by its being ordinarily produced in a dense cloud. The mode of explaining thunder, &c. which we would therefore prefer, is, that when a large mass of warm and damp air is suddenly moved upwards, it dilates, is cooled, and deposits a considerable share of its moisture, which, in laying aside the gaseous form, parts with positive electricity so suddenly, and in such quantity, that the air is unable to conduct or convey it away in an imperceptible form; and thus the cloud, at the moment of its formation, may in ordinary language be said to emit lightning. The sound may be partly a tremor which the air sustains at the moment the pressure is relaxed by the vapour suddenly losing the elastic form, and may be partly a tremor due to an effort of the electricity to make its escape from the cloud. The thunder and lightning which sometimes attend the condensations of large volumes of steam emitted by volcanoes, are favourable to this theory, as are likewise the noise and lightning of the water-spout already mentioned, if not some parts of the northern lights. A theory very similar to this, though more in detail, was not long ago proposed to the Royal Society, by the Rev. G. Fisher; but the same thing had been previously suggested by Mr Meikle, in the *Quarterly Journal of Science* for April 1829.

Several important matters connected with this subject we have not felt warranted to introduce, on account of their not being yet determined by sufficiently extensive observations; such as the maximum, mean, and minimum dew-points for different hours of the day, for different seasons of the year, for different heights in the atmosphere, and in different countries. We now take leave of the subject by referring again to the various works already cited here, and in the article EVAPORATION; as also to the *Reports of the British Association*, particularly the very excellent one by Professor Forbes on Meteorology. See also the articles ATMOSPHERE, AURORA-BOREALIS, CLIMATE, CLOUD, DEW, &c. in this work. (E. E. E.)

HYGROSCOPE. The same with HYGROMETER.

HYLOZOISTS, formed from ὕλη, *matter*, and ζωη, *life*, the name of a sect of atheists amongst the ancient Greek philosophers, who maintained that matter had some natural perception, strictly so called, without animal sensation or reflection; but that this imperfect life occasioned that organization whence sensation and reflection afterwards arose. Of these, some held that there was only one life, which they called a plastic nature, presiding regularly and invariably over the whole corporeal universe, represented by them as a kind of large plant or vegetable. These were called the cosmoplastic and stoical atheists, because the Stoics believed such a nature, though many of them supposed it to be the instrument of the Deity. But others thought that every particle of matter was endowed with life, and represented the mundane system as depending upon a certain mixture of chance and plastic or orderly nature united together. These were called the *Stratonici*, from Strato Lampsacenus, a disciple of Theophrastus, called also Physicus (Cicero *De Nat. Deor.* lib. i. cap. 13), who was first a celebrated Peripatetic, and afterwards formed this new system of atheism for himself. Besides these two forms of atheism, some of the ancient philosophers were Hylopathians, or Anaximandrians, deriving all things from dead and stupid matter, in the way of qualities and forms, generative and corruptible; and others again adopted the atomical or Democritical system, by which the production of the universe is ascribed to atoms and figures.

HYMENÆAL, something belonging to marriage, and so called from HYMEN.

Hymenæus.

HYMENÆUS, or HYMEN, the god of marriage amongst the Greeks, the son of Apollo and Calliope, or of Bacchus and Venus. Others have thought that he was an Athenian youth, who disguised himself in female attire, that he might accompany his mistress to Eleusis, when she went with others to offer up sacrifice. They were seized by pirates and carried to sea; but Hymenæus encouraged his female companions, and with their assistance put the pirates to death. The Athenians were so pleased at the rescue of their friends, that they allowed him to marry the lady of his affection, who had been refused to him till that time. Hymenæus enjoyed so much happiness from his marriage, that the Athenians invoked him solemnly at their nuptials, as the Romans did Thalassius.

He is represented by the poets as crowned with flowers, particularly with marjoram, having a *flammeum* (veil of a flame colour) on his head, and a torch in his hand. (Serv. *Ecl.* viii. 30; *Æn.* iv. 99, 127; Donat. *Ter. Adel.* v. 7, 6; Lactan. *Stat. Theb.* iii. 283.)

HYMENOPTERA, derived from ὑμην, *membrane*, and πτερον, *wing*, in the Linnæan system of natural history, is an order of insects having four membranaceous wings, whilst the tails of the females are furnished with stings, which in some are used for instilling poison, and in others for merely piercing the bark and leaves of trees, and the bodies of other animals, in which they deposit their eggs.

HYMETTUS, in *Ancient Geography*, a mountain of Attica, near Athens, celebrated for its marble quarries, and for its excellent honey. Pliny says that the orator Crassus was the first who had columns executed from the marble of Hymettus.

HYMN, a song or ode in honour of God, or a poem, proper to be sung, composed in honour of some deity. The word is Greek, ὑμνος, *hymn*, formed from the verb ὑδω, *celebro*, I celebrate. Isidore remarks on this word, that *hymn* is properly a song of joy, full of the praises of God, by which, according to him, it is distinguished from *threna*, which is a mourning song, full of lamentation.

St Hilary, bishop of Poictiers, is said to have been the first who composed hymns to be sung in churches; and he was followed by St Ambrose. Most of those contained in the Roman breviary were composed by Prudentius. They have been translated into French verse by Messieurs de Port-Royal. In the Greek liturgy there are four kinds of hymns; but the word is not employed in the sense of a praise offered in verse, but simply of a laud or praise. The angelic hymn, or *Gloria in excelsis*, is of the first kind; the trisagion is of the second; the Cherubic hymn is of the third; and the hymn of *victory* and *triumph*, called ἐπινικιος, the last.

The hymns or odes of the ancients generally consisted of three sorts of stanzas; one of which, called *strophe*, was sung by the band as they walked from east to west; another, called *antistrophe*, was performed as they returned from west to east; and the third part, or *epode*, was sung before the altar. The Jewish hymns were accompanied with trumpets, drums, and cymbals, to assist the voices of the Levites and the people.

HYPALLAGE, amongst grammarians, a species of hyperbaton, consisting in a mutual permutation of one case for another. Thus Virgil says, *Dare classibus austros*, for *dare classes austris;* and again, *Nec dum illis labra admovi*, for *nec dum illa labris admovi.*

HYPANTE, or Hyperpante, a name given by the Greeks to the feast of the presentation of Jesus in the temple. This word, which signifies *lowly* or *humble meeting*, was given to this feast from the meeting of old Simeon and Anna the prophetess in the temple, when Jesus was brought thither.

HYPATIA, a learned and beautiful lady of antiquity, the daughter of Theon, a celebrated philosopher and mathematician, and president of the Alexandrian school, was born at Alexandria about the end of the fourth century. Her father, encouraged by her extraordinary genius, had her not only educated in all the ordinary accomplishments of her sex, but instructed in the most abstruse sciences. In philosophy, geometry, and astronomy she made such progress, that she was justly accounted the most learned person of her time. At length she was thought worthy to succeed her father in the government of the school of Alexandria, and to teach from that chair where Ammonius, Hierocles, and many other great men, had taught before; and this at a time too when men of great learning abounded both at Alexandria and in many other parts of the Roman empire. Her fame was so extensive, and her worth so universally acknowledged, that her prelections were attended by a crowded auditory. One cannot represent to himself, without pleasure, the flower of all the youth of Europe, Asia, and Africa, sitting at the feet of a very beautiful woman (for such we are assured Hypatia was), all greedily imbibing instruction from her mouth, and many of them, doubtless, love from her eyes; though we are not sure that she ever listened to any solicitations, since Suidas, who talks of her marriage with Isiodorus, at the same time relates, not very consistently, that she died a maid.

Her scholars were as eminent as they were numerous. One of them was the celebrated Synesius, who afterwards became bishop of Ptolemais. This ancient Christian Platonist everywhere bears the strongest as well as the most grateful testimony to the virtue of his tutoress; and never mentions her without the most profound respect, and sometimes in terms of affection little short of adoration. But it was not Synesius and the disciples of the Alexandrian school alone who admired Hypatia for her virtue and learning. Never was woman more caressed by the public, and yet never woman maintained a more unspotted character. She was held as an oracle for her wisdom, which made her be consulted by the magistrates in all important cases; and this frequently drew her into the greatest intercourse with men, without the least censure of her manners. In a word, when Nicephorus intended to pay the highest compliment to the Princess Eudocia, he thought he could not do it better than by calling her another Hypatia.

Whilst Hypatia thus reigned as the brightest ornament of Alexandria, Orestes governed the same place for the Emperor Theodosius, and Cyril was bishop or patriarch. Orestes having received a liberal education, could not but admire Hypatia; and, as a wise governor, he frequently consulted her. But this, together with an aversion which Cyril entertained to Orestes, proved fatal to the lady. One day about five hundred monks having assembled, attacked the governor, and would have killed him, had he not been rescued by the townsmen; and the respect which Orestes entertained for Hypatia causing her to be traduced amongst the Christian multitude, they dragged her from her chair, tore her in pieces, and burned her limbs. Cyril is more than suspected of having fomented this tragedy. Cave indeed endeavours to remove from the patriarch the imputation of so horrid an action, and lays it upon the Alexandrian mob in general, whom he calls *levissimum hominum genus*, a very fickle, inconstant race. But though Cyril should be allowed to have been neither the perpetrator, nor even the contriver, of the murder, yet it is strongly suspected that he did not discountenance it in the manner he ought to have done; and this suspicion is greatly confirmed by reflecting that he was so far from blaming the outrage committed by the monks upon Orestes, that he afterwards received the dead body of Ammonius, one of the most forward in that outrage, who had grievously wounded the governor, and who was justly punished with death.

HYPER, a Greek preposition frequently used in composition, where it denotes excess; its literal signification being *above* or *beyond*.

HYPERBATON, in *Grammar*, a figurative construction, inverting the natural and proper order of words and sentences. The several species of the hyperbaton are, the anastrophe, the hysteron-proteron, the hypallage, synchysis, tmesis, parenthesis, and the hyperbaton strictly so called.

Hyperbaton, strictly so called, is a long retention of the verb which completes the sentence, as in the following example from Virgil:

> Interea Reges: ingenti mole Latinus
> Quadrijugo vehitur curru, cui tempora circum
> Aurati bis sex radii fulgentia cingunt,
> Solis avi specimen: bigis it Turnus in albis,
> Bina manu lato crispans hastilia ferro:
> Hinc Pater Æneas, Romanæ stirpis origo,
> Sidereo flagrans clypeo et cœlestibus armis;
> Et juxta Ascanius, magnæ spes altera Romæ:
> Procedunt castris.

HYPERBOLA, a curve formed by cutting a cone in a direction parallel to its axis. See CONIC SECTIONS.

HYPERBOLA Deficient is a curve having only one asymptote, though two hyperbolic legs running out infinitely by the side of the asymptote, but contrariwise.

HYPERBOLE, in *Rhetoric*, a figure by which the truth and reality of things are either enlarged or diminished, exaggerated or depreciated.

An object uncommon in respect of size, that is either very great of its kind or very little, strikes us with surprise; and this emotion forces upon the mind a momentary conviction that the object is greater or less than it is in reality. The same effect precisely attends figurative grandeur or littleness; and hence arises the hyperbole, which expresses this momentary conviction. A writer, taking advantage of this natural delusion, enriches his description greatly by the hyperbole; and the reader, even in his coolest moments, relishes this figure, being sensible that it is the operation of nature upon a warm fancy.

It cannot have escaped observation, that a writer is generally more successful in magnifying by a hyperbole than in diminishing. The reason is, that a minute object contracts the mind, and fetters its powers of imagination; but the mind, dilated and inflamed with a grand object, moulds with great facility objects for its gratification. Longinus, treating a diminishing hyperbole, cites the following ludicrous thought from a comic poet: "He was owner of a bit of ground not larger than a Lacedæmonian letter." But, for the reason now given, the hyperbole has far the greater force in magnifying objects.

Quintilian holds the hyperbole to be a natural figure: "For," says he, "not contented with truth, we naturally incline to augment or diminish beyond it; and for this reason the hyperbole is familiar even amongst the vulgar and illiterate;" and he adds, very justly, "that the hyperbole is then proper, when the object of itself exceeds the common measure."

HYPERBOREAN, in *Ancient Geography*, a term applied to those people and places which were to the northward of the Scythians. The ancients had but very little acquaintance with the Hyperborean regions; and all that they tell us respecting them is doubtful, and much of it positively false. According to Diodorus Siculus, the Hyperboreans were so called by reason that they dwelt beyond the wind Boreas; ὑπερ signifying above or beyond, and Βορεας, *Boreas*, the north wind. This etymology is natural and plausible, notwithstanding all that has been said against it by Rudbeck, who contends that the word is Gothic, and signifies *nobility*. Herodotus doubts whether or not there were any such nations as the Hyperboreans. Strabo, who professes to believe that there were, does not take *hyperborean* to signify *beyond Boreas* or the north, as Herodotus understood it. The preposition ὑπερ, in this case, he supposes only to help to form a superlative, so that *hyperborean*, on his principles, means no more than *most northern*; from which it appears that the ancients themselves scarcely knew what the name meant. Several of our modern geographers, as Hoffman, Cellarius, and others, have placed the Hyperboreans in the northern parts of the European continent, that is, amongst the Siberians and Samoieds. According to them, the Hyperboreans of the ancients were those in general who lived farthest to the north. The Hyperboreans of our days are those Russians who inhabit the country between the Volga and the White Sea. According to Cluvier, the name Celts was synonymous with that of Hyperboreans.

HYPERCATALECTIC, in the Greek and Latin poetry, is applied to a verse that has one or two syllables too much, or beyond the regular and just measure; as,

> Musæ sorores sunt Minervæ:

Also,

> Musæ sorores Palladis lugent.

HYPERCRITIC, an over-rigid censor or critic; one who will let nothing pass, but animadverts severely on the slightest fault. The word is compounded of ὑπερ, *super*, over, above, beyond; and κριτικος, from κριτης, *judex*, a verbal form of κρινω, *judico*, I judge.

HYPERDULIA, in the Roman Catholic theology, is the worship rendered to the holy virgin. The word is Greek, ὑπερδυλεια, composed of ὑπερ, *above*, and δυλεια, *worship, service*. The worship offered to saints is called *dulia*; and that to the mother of God, *hyperdulia*, as being superior to the former.

HYPERIDES, a celebrated orator of Athens, was son of Glaucippus, respecting whose private history we are able to collect a few facts from the Orations of Demosthenes and the Bibliotheca of Photius (p. 1479). The exact date of his birth is not known; but he was put to death B. C. 322, the same year in which Demosthenes poisoned himself. He studied philosophy under Plato, but not along with Isocrates, as is stated by Photius; for Isocrates was born B. C. 436, and must have been far advanced in years when Hyperides was born. Hyperides adopted the same line of politics as Demosthenes, and opposed with great perseverance the proceedings of Philip of Macedon. That monarch, dreading lest the Athenians should be inclined to throw obstacles in the way of his projects, took into his pay many of the chief orators of Athens, at the head of whom was Æschines. Demosthenes, who was chief of the opposite party, recommended an alliance with the king of Persia, whose dominions were equally threatened by Philip; and it would appear that Hyperides and Ephialtes were employed in a secret negotiation for this purpose. When Eubœa was threatened with invasion by Philip, Hyperides, finding that the Athenians were wasting the time in vain debates, had sufficient influence with the richer citizens to prevail upon them to fit out a fleet of forty triremes, two of which he equipped at his own expense. He was employed under Phocion, in the expedition which was sent to the assistance of Byzantium, when it was besieged by Philip, B. C. 339; and after the battle of Chæronea, B. C. 338, it was through his energetic means that Athens obtained an honourable peace. He was afterwards accused by Aristogeiton of having violated at this period all the laws of the republic; but in his defence he made that celebrated reply, that he had been dazzled by the arms of the Macedonians, and that it was not he, but the battle of Chæronea, which had caused the decree to pass of which he was now accused. He was one of the few whose lives were demanded of the Athenians by Alexander, after the destruction of Thebes, B. C. 335; but it appears that Demades contrived to appease the wrath of the prince, and Hyperides was allowed to remain in his country. He seems to have been honourably distinguished from the orators of his time by an entire freedom from avarice; he resisted the bribes of Harpalus, and was therefore employed to prosecute those who had allowed themselves to be corrupted; he was also one of the accusers of Demosthenes. The troops, however, which Harpalus had brought with him he advised the Athenians to retain; and by means of these, upon the death of Alexander, B C. 323, they were able to commence the Lamian war. Leosthenes the general fell, with many of his troops; and the funeral oration which was pronounced over them by Hyperides was considered by the ancients as one of the most beautiful of its kind. After the defeat of the Greeks, Hyperides was banished from Athens; and having retired to Ægina, was there reconciled to Demosthenes. Being pursued by the Macedonians, he fled to the Temple of Neptune at Hermina, and he was there seized by Archias, who carried him to Corinth, where Antipater then was. Being subjected to torture, some say that he bit off his tongue, that he might not be induced to betray the secrets of his country; whilst others assert that it was cut out by order of Antipater, and that he was then put to death, B. C. 322. Cicero places him immediately after Demosthenes as an orator. There were fifty-two orations of his extant in the time of Photius, and twenty-five others which Photius did not consider as genuine. None of his works have been preserved.

HYPERMNESTRA, in fabulous history, one of the fifty daughters of Danaus, king of Argos. She alone refused to obey the cruel order which Danaus had given to all his daughters, to murder their husbands the first night of their marriage; and therefore saved the life of Lynceus, after she had made him promise not to violate her virginity. Danaus, enraged at her disobedience, confined her closely in prison, whence Lynceus delivered her some time afterwards.

HYPHEN, an accent or character in grammar, implying that two words are to be joined, or connected into one compound word, and marked thus -; as *pre-established*, *five-leaved*, and the like. Hyphens also serve to connect the syllables of such words as are divided by the end of the line.

HYPNOTIC, in the *Materia Medica*, such medicines as in any way produce sleep, whether called *narcotics*, *hypnotics*, *opiates*, or *soporifics*.

HYPO, a Greek particle, retained in the composition of different words borrowed from that language, and literally denoting *under*, *beneath*. In this sense it stands opposed to ὑπερ, *supra*, above.

HYPOBOLE, or Subjection (from ὑπο, and βαλλω, *I cast*), in *Rhetoric*, a figure which is so called because several things are mentioned which seem to make for the contrary side, and each of them is refuted in order. This figure, when complete, consists of three parts; a proposition, an enumeration of particulars with the answers to these, and a conclusion.

HYPOCATHARSIS (compounded of ὑπο, *under*, and καθαιρω, *I purge*), in *Medicine*, a too faint or feeble purgation.

HYPOCAUSTUM, amongst the Greeks and Romans, a subterraneous place, where there was a furnace to heat the baths. The word is Greek, formed from the preposition ὑπο, *under*, and the verb καιω, *to burn*. Amongst the moderns, the *hypocaustum* is that place where the fire is kept which warms a stove or hot-house.

HYPOCHONDRIAC Passion, a disease in men, similar to the hysterical affection in women.

HYPOCRISY, ὑποκρισις, denotes dissimulation with regard to the moral or religious character. In other words, it signifies one who feigns to be what he is not; and it is generally applied to those who assume the appearances of virtue or religion, without in reality having any thing of either.

HYPOGÆUM, ὑπογαιον, formed from ὑπο, *under*, and γαια, *earth*, in the ancient architecture, is a name common to all the parts of a building which are under ground; as the cellar, butteries, and such like places. The term *hypogæum* was used by the Greeks and Romans for subterraneous tombs in which they buried their dead.

Hypogæum, ὑπογαιον, in *Astrology*, is a name given to the celestial houses which are below the horizon; especially the *imum cœli*, or bottom of heaven.

HYPOGASTRIC, an appellation given to the internal branch of the iliac artery.

HYPOGLOTTIS, or Hypoglossis, composed of ὑπο, *under*, and γλωττα, *tongue*, in *Anatomy*, is a name given to two glands of the tongue. There are four large glands of the tongue; two of them, called *hypoglottides*, are situated under it, near the *venæ ranulares*, one on each side of the tongue. They serve to secrete a kind of serous matter of the nature of saliva, which is discharged into the mouth by little ducts near the gums.

Hypoglottis, or *Hypoglossis*, in *Medicine*, denotes an inflammation or ulceration under the tongue, called also *ranula*.

HYPOPYON, in *Medicine*, a collection of purulent matter under the corner of the eye.

HYPOSCENIUM, in *Antiquity*, a partition under the pulpit or logeum of the Greek theatre, appointed for the music.

HYPOSTASIS, a Greek term, literally signifying *substance*, or *subsistence*, and used in theology for *person*. The word is Greek, ὑποστασις, compounded of ὑπο, *sub*, under, and ἱστημι, *sto*, *existo*, I stand, I exist; as if we were to say *subsistentia*. Thus we hold that there is but one nature or essence in God, but three *hypostases* or persons. The term *hypostasis* is of a very ancient standing in the church. St Cyril repeats it several times, as also the phrase "union according to hypostasis." The first time it occurs is in a letter from that father to Nestorius, where he uses it instead of προσωπον, the word we commonly render *person*, which did not seem expressive enough. "The philosophers," says St Cyril, "have allowed three *hypostases*. They have extended the divinity to three *hypostases*; they have even sometimes used the word *trinity*; and nothing was wanting but to have admitted the consubstantiality of the three *hypostases*, to show the unity of the divine nature, exclusively of all triplicity in respect of distinction of nature, and not to hold it necessary to conceive any respective inferiority of *hypostases*."

This term occasioned great dissensions in the ancient church; first amongst the Greeks, and afterwards amongst the Latins. In the council of Nice, *hypostasis* was defined to denote the same thing with *essence* or *substance*; so that it was heresy to say that Jesus Christ was of a different *hypostasis* from the Father; but custom altered the meaning of the term. In the necessity they were under of expressing themselves strongly against the Sabellians, the Greeks made choice of the word *hypostasis*, and the Latins of the word *persona*; a change which proved the occasion of endless disagreement. The phrase τρεις ὑποστασεις, used by the Greeks, scandalized the Latins, whose usual way of rendering ὑποστασις in their language was by *substantia*. The barrenness of the Latin tongue in theological phrases allowed them but one word for the two Greek ones, ουσια and ὑποστασις, and thus disabled them from distinguishing *essence* and *hypostasis*; for which reason they chose rather to use the term *tres personæ*, and *tres hypostases*. But an end was put to disputation, in a synod held at Alexandria about the year 362, at which St Athanasius assisted; and from this time the Latins made no great scruple of saying *tres hypostases*, nor the Greeks of saying *three persons*.

HYPOTHECA, in the *Civil Law*, an obligation by which the effects of a debtor are made over to his creditor, in security of his debt. The word comes from the Greek ὑποθηκη, *a thing subject to some obligation*, from the verb ὑποτιθημαι, *suppono*, I am subjected.

As the *hypotheca* is an engagement procured on purpose for the security of the creditor, various means have been employed to secure to him the benefit of the convention. The use of the pawn or pledge is the most ancient, which is almost the same thing with the *hypotheca*, all the difference consisting in this, that the pledge is put into the creditor's hands, whereas, in a simple *hypotheca*, the thing remained in the possession of the debtor. It was found more easy and commodious to engage an estate by a civil covenant than by an actual delivery. Accordingly the expedient was first practised amongst the Romans; and from them the Greeks borrowed both the name and the thing; only, the better to prevent frauds, they used to fix some visible mark on the thing, that the public might know it was hypothecated or mortgaged by the proprietor; but the Romans, looking on such advertisements as injurious to the debtor, forbade the use of them.

The Roman lawyers distinguished four kinds of hypothecs; the conventional, which was with the will and consent of both parties; the legal, which was appointed by law, and for that reason called *tacit;* the prætor's pledge, when by the flight or non-appearing of the debtor, the creditor was put in possession of his effects; and the judiciary, when the creditor was put in possession by virtue of a sentence of the court.

The conventional *hypotheca* is subdivided into general and special. The *hypotheca* is general, when all the debtor's effects, both present and future, are engaged to the creditor. It is special, when limited to one or more particular things. With regard to the tacit *hypotheca*, the civilians reckon no less than twenty-six different species of this genus.

HYPOTHENUSE, in *Geometry*, the longest side of a right-angled triangle, or that which subtends the right angle.

HYPOTHESIS, formed from ὑπο, *under*, and θεσις, *positio*, from τιθημι, *pono*, I put, is a proposition or principle which we suppose, or take for granted, in order to draw conclusions for the proof of a point in question.

Every conditional or hypothetical proposition may be distinguished into hypothesis and thesis. The first rehearses the conditions under which any thing is affirmed or denied; and the second is the thing itself affirmed or denied. Thus, in the proposition, a triangle is half of a parallelogram, if the bases and altitudes of the two be equal, the latter part is the hypothesis, and the former a thesis.

In strict logic, we are never to pass from the hypothesis to the thesis; that is, the principle supposed must be proved to be true, before we require the consequence to be allowed.

It has become common, since the time of Newton, to decry all reasoning from hypotheses, as useless and unphilosophical. But was not the theory of gravitation itself founded upon a conjecture, that is, upon an hypothesis? It was founded upon the supposition that the power which regulates the fall of heavy bodies also regulates the motion of the moon; a supposition upon which he proceeded to reason before it was verified by calculation. The subject of the use and abuse of hypotheses in philosophical inquiries has been admirably illustrated by Mr Stewart, in the second volume of his *Philosophy of the Mind;* and to that book we refer those who wish to form accurate notions on this subject.

HYPOTRACHELION, in *Architecture*, is used for a little frize in the Tuscan and Doric capital, between the astragal and annulets, and which is also called the *colerin* and *gorgerin*. The word is applied by some authors in a more general sense, to the neck of any column, or that part of its capital below the astragal.

HYPSISTARII (formed from ὑψιστος, *highest*), a sect of heretics in the fourth century, who were so called from the profession they made of worshipping the Most High God.

The doctrine of the Hypsistarians may be considered as an assemblage of Paganism, Judaism, and Christianity. They adored the Most High God with the Christians; but they also revered fire and lamps with the heathens, and observed the sabbath, and the distinction of clean and unclean things with the Jews.

The Hypsistarii bore a near resemblance to the Euchites, or Massalians.

HYRCANIA, in *Ancient Geography*, a country of the Farther Asia, lying to the south-east of the *Mare Hyrcanum* or *Caspium;* with Media on the west, Parthia on the south, and Margiana on the east.

HYSTERICAL AFFECTION, or *Passion* (formed from ὑστερα, *womb*), a disease in women, called also *suffocation of the womb*, and vulgarly *fits of the mother*. It is a spasmodico-convulsive affection of the nervous system, proceeding from the womb.

HYSTERON PROTERON, in *Grammar* and *Rhetoric*, a species of the hyperbaton, in which the proper order of construction is so inverted, that the part of any sentence which should naturally come first is placed last. Thus in Terence, *Valet et vivit*, for *vivit et valet;* and in Virgil, *Moriamur, et in media arma ruamus*, for *In media arma ruamus, et moriamur.*

HYTHE, a borough town of the county of Kent, in the parish of Saltwood, in the hundred of Horne, sixty-seven miles from London. It is one of the Cinque Ports, and as such returns one member to the House of Commons, who is chosen by about 420 voters. It consists chiefly of one long and well-built street, parallel to the shore, about a mile from the sea. In a vault under the church is a vast collection of dry human bones, which, according to tradition, are the remains of a great battle fought here between the Danes and the Britons antecedent to the Norman conquest. The inhabitants amounted in 1801 to 1365, in 1811 to 2318, in 1821 to 2181, and in 1831 to 2287.

I.

I, or *i*, the ninth letter and third vowel of the alphabet, is pronounced by throwing the breath suddenly against the palate, as it comes out of the larynx, with a small hollowing of the tongue, and nearly the same opening of the lips as in pronouncing *a* or *e*. Its sound varies; in some words it is long, as *high, mind;* in others short, as *bid, hid, sin;* in others, again, it is pronounced like *y*, as in *collier, onion;* and in a few it sounds like *ee*, as in *machine, magazine*, and the like. No English word ends in *i*, *e* being either added to it, or else the *i* turned into *y*. But besides the vowel, there is the *jod* consonant, which, because of its different pronunciation, has likewise a different form, thus, J, j. In English it has the soft sound of *g;* nor is it used excepting when *g* soft is required before vowels, where *g* is usually hard. Thus we say, *jack, jet, join*, instead of *gack, get, goin*, which would be contrary to the genius of the English language.

I, used as a numeral, signifies *one*, and stands for as many units as it is times repeated: thus I. one, II. two, III. three; and when put before a higher numeral, it subtracts itself, as IV. four, IX. nine, and so on. But when placed after it, as many are added to the higher numeral as there are I's added. Thus, VI. is 5 + 1, or six; VII. 5 + 2, or seven; VIII. 5 + 3, or eight. The ancient Romans likewise used IƆ for 500, CIƆ for 1000, IƆƆ for 5000, CCIƆƆ for 10,000. Further than this they did not go in their notation, but, when necessary, repeated the last number, as CCCIƆƆƆ, CCCIƆƆƆ, for 200,000; CCCIƆƆƆ, CCCIƆƆƆ, CCCIƆƆƆ, for 300,000; and so on. The ancients sometimes changed *i* into *u;* as *decumus* for *decimus; maxumus* for *maximus*, and so on. According to Plato, the vowel *i* is proper to express delicate but humble things, as in the verse of Virgil:

> Accipiunt inimicum imbrem, rimisque fatiscunt.

I, used as an abbreviature, is often substituted for the word Iesus, of which it is the first letter.

IAMBIC, in ancient poetry, a sort of verse, so called from its consisting either wholly, or in a great measure, of iambuses. See Iambus.

Ruddiman makes two kinds of iambic verse, viz. dimeter and trimeter; the former containing four feet, and the latter six. And as to the variety of feet, they consist wholly of iambuses, as in the two following verses of Horace:

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      1    2    3    4    5    6
Dim.  Inar|sit æ|stuo|sius|
Trim. Suis|et i|psa Ro|ma vi|ribus|ruit.
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Or a dactyle, spondee, anapest, and sometimes a tribrachys, obtain in the odd places; and the tribrachys also in the even places, excepting the last. Examples of all this may be seen in Horace. Thus,

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1      2      3       4          5        6
Canidi|a tra|ctavit|dapes|
Vide|re prope|rantes|domum|
Quoquo|scele|sti rui|tis aut|cur dex|teris.
Prius|que cœ|lum si|det in|ferius|mari.
Aliti|bus at|que cani|bus homi|cid' He|ctorem.
Pavidum|que lepo|r' aut ad|venam laqueo|gruem.
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IAMBUS, in the Greek and Latin prosody, a poetical foot, consisting of a short syllable followed by a long one; as in

> ᴗ – ᴗ – ᴗ – ᴗ –
> Θεου, λεγω, Deī, meas.

"*Syllaba longa brevi subjecta vocatur* iambus," as Horace expresses it; and he also calls the iambus a swift, rapid foot, *pes citus*.

The word, according to some, took its rise from Iambus, the son of Pan and Echo, who invented this foot; or, perhaps, who only used sharp, biting expressions to Ceres, when afflicted for the death of Proserpine. Others derive it from the Greek ἰος, *venenum*, poison; or from ἰαμβιζω, *maledico*, I rail or revile, because the verses composed of iambuses were at first used only in satire.

IBERIA, Spain, so called by the ancients, from the river Iberus or Ebro.

Iberia was also the name of an inland country of Asia, having to the west Colchis, with part of Pontus; to the north Mount Caucasus; on the east Albania; and on the south Armenia Magna. It is now the western part of Georgia.

IBYCUS, a Greek lyric poet who flourished 550 B. C., and of whose works there are only a few fragments remaining. It is said that he was assassinated by robbers, and that when dying he called upon some cranes he saw flying past to bear witness. Not long afterwards one of the murderers seeing some cranes, said to his companions, "There are the witnesses of Ibycus's death;" which being reported to the magistrates, the assassins were put to the torture, and having confessed the fact, were hanged. And hence arose the proverb *Ibyci Grues*.

ICE, a solid, transparent, and brittle body, formed of some fluid, particularly water, by means of cold.

M. Lemery observes, that ice is only a re-establishment of the parts of water in their natural state; that the mere absence of fire is sufficient to account for this re-establishment; and that the fluidity of water is a real fusion, like that of metals exposed to the fire; differing only in this, that a greater quantity of fire is necessary to the one than the other. Galileo was the first who observed that ice was lighter than the water which composed it; and hence it happens that ice floats upon water, its specific gravity being to that of water as eight to nine. This rarefaction of ice seems to be owing to the air-bubbles produced in water by freezing, and which, being considerably large in proportion to the water frozen, render the body so much specifically lighter. These air-bubbles, during their production, acquire a great expansive power, so as to burst the containing vessels, though ever so strong.

M. Mairan, in a dissertation on ice, attributes the increase of its bulk chiefly to a different arrangement of the parts of the water from which it is formed; the icy skin on the water being composed of filaments, which, according to him, are found to be constantly and regularly joined at an angle of 60°; and which, by this angular disposition, occupy a greater volume than if they were parallel. He found the augmentation of the volume of water by freezing, in different trials, a fourteenth, an eighteenth, a nineteenth, and, when the water was previously purged of air, only a twenty-second part; that ice, even after its formation, continues to expand by cold; for, after water had been frozen to some thickness, the fluid part being let out by a hole in the bottom of the vessel, a continuance of the cold made the ice convex; and a piece of ice which was at first only a fourteenth part specifically lighter than water, on being exposed some days to the frost, became a twelfth part lighter. To this cause he attributes the bursting of ice on ponds.

Though it has been generally supposed that the natural crystals of ice are stars of six rays, forming angles of 60° with each other, yet this crystallization of water, as it may properly be called, seems to be as much affected by circumstances as that of salts. Hence we find a considerable difference in the accounts of those who have undertaken to describe these crystals. M. Mairan informs us that they are stars with six radii; and his opinion is confirmed by observing the figure of frost on glass. M. Romé de l'Isle determines the form of the solid crystal to be an equilateral octahedron; M. Hassenfratz found it to be a prismatic hexahedron; but M. d'Antic found a method of reconciling these seemingly opposite opinions. In a violent hail-storm, where the hailstones were very large, he found that they had sharp wedge-like angles of more than half an inch; and in these he supposed it impossible to see two pyramidal tetrahedra joined laterally, and not to conclude that each grain was composed of octahedrons converging to a centre. Some had a cavity in the middle; and he saw the opposite extremities of two opposite pyramids, which constitute the octahedron; he likewise saw the octahedron entire united in the middle; all of them were therefore similar to the crystals formed upon a thread immersed in a saline solution. On these principles M. d'Antic constructed an artificial octahedron resembling one of the largest hailstones, and found that the angle at the summit of the pyramid was 45°, but that of the junction of the two pyramids 145°. It is not, however, easy to procure regular crystals in hailstones, where the operation is conducted with such rapidity; in snow and hoar-frost, where the crystallization goes on more slowly, our author is of opinion that the rudiments of octahedra may be discovered. (See the section on CONGELATION, in the article COLD.)

Blink of the Ice.

Blink of the ICE, is a name given by the pilots to a bright appearance near the horizon, occasioned by the ice, and observed before the ice itself is seen.

ICE-Boats, boats so constructed as to sail upon ice, and which are very common in Holland. They go with incredible swiftness, sometimes so quickly as to affect the breath, and are found very useful in conveying goods and passengers over lakes and great rivers. Boats of different sizes are placed in a transverse form upon a two-and-a-half or three-inch deal board. At the extremity of each end are fixed irons, which turn up in the form of skaits. Upon this plank the boat rests, and the two ends serve as out-riggers to prevent oversetting; whence ropes are fastened that lead to the head of the mast in the nature of shrouds, and others passed through a block across the bowsprit. The rudder is made somewhat like a hatchet with the head placed downwards, which being pressed down, cuts the ice, and serves all the purposes of a rudder in the water, by enabling the helmsman to steer.

Ice-House.

ICE-House, a repository for ice during the summer months. The aspect of ice-houses should be towards the east or south-east, for the advantage of the morning sun to expel the damp air, as that is more pernicious than warmth; for which reason trees in the vicinity of an ice-house tend to its disadvantage. The best soil for an ice-house to be made in is chalk, as it conveys away the waste water without any artificial drain; the next to that is loose stony earth or gravelly soil.

Ice may be preserved in a dry place under ground, by covering it well with chaff, straw, or reeds. Great use is made of chaff in some places of Italy to preserve ice; the ice-house for this purpose need only be a deep hole dug in the ground on the side of a hill, from the bottom of which they can easily carry out a drain, to let out the water which is separated at any time from the ice, that it may not melt and spoil the rest. If the ground is tolerably dry, they do not line the sides with any thing, but leave them naked, and only make a covering of thatch over the top of the hole. This pit they fill either with pure snow, or else with ice taken from the purest and clearest water; because they do not use it, as we do in England, to set the bottles in, but really mix it with the wine. They first cover the bottom of the hole with chaff, and then lay in the ice, not letting it anywhere touch the sides, but ramming in a large bed of chaff all the way between; they thus carry on the filling to the top, and then cover the surface with chaff. Ice packed in this manner will keep as long as they please. When they take any of it out for use, they wrap up the lump in chaff, and it may then be carried to any distant place without waste or melting.

It appears from the investigations of Professor Beckman, in his History of Inventions, that the ancients, from the earliest ages, were acquainted with the method of preserving snow for the purpose of cooling liquors in summer. "This practice," he observes, "is mentioned by Solomon; and proofs of it are so numerous in the works of the Greeks and the Romans, that it is unnecessary for me to quote them, especially as they have been collected by others. How the repositories for keeping it were constructed we are not expressly told; but it is probable that the snow was preserved in pits or trenches.

"When Alexander the Great besieged the city of Petra, he caused thirty trenches to be dug, and filled with snow, which was covered with oak branches, and which kept in that manner for a long time. Plutarch says that a covering of chaff and coarse cloth is sufficient; and at present a like method is pursued in Portugal. Where the snow has been collected in a deep gulf, some grass or green sods, covered with dung from the sheep pens, is thrown over it; and under these it is so well preserved, that, the whole summer through, it is sent the distance of sixty Spanish (nearly 180 English) miles to Lisbon.

"When the ancients, therefore, wished to have cooling liquors, they either drank the melted snow, or put some of it in their wine; or they placed jars filled with wine in the snow, and suffered it to cool there as long as they thought proper. That ice was also preserved for the like purpose, is probable from the testimony of various authors; but it appears not to have been used so much in warm countries as in the northern. Even at present snow is employed in Italy, Spain, and Portugal; but in Persia ice. I have never any where found an account of Grecian or Roman ice-houses. By the writers on agriculture they are not mentioned."

Ice-Island.

ICE-Island, a name given by sailors to a great quantity of ice collected into one huge solid mass, and floating about upon the seas near or within the polar circles. The motion of the lesser pieces is as rapid as the currents: the greater, which are sometimes two hundred leagues long, and sixty or eighty broad, move slowly and majestically; often fix for a time, immoveable by the power of the ocean, and then produce near the horizon that bright white appearance called the *ice-blink*. The approximation of two great fields produces a most singular phenomenon; it forces the lesser (if the term can be applied to pieces of several acres square) out of the water, and adds it to the surface; a second, and often a third succeeds, so that the whole forms an aggregate of a tremendous height. These float in the sea like so many rugged mountains, and are sometimes five or six hundred yards thick; but the far greater part is concealed beneath the water. These are continually increased in height by the freezing of the spray of the sea, or the melting of the snow which falls on them. Those which remain in this frozen climate receive continual additions; others are gradually wafted by the northern winds into southern latitudes, and melt by degrees by the heat of the sun, till they waste away, or disappear in the boundless element.

ICEBERGS are large bodies of ice filling the valleys between the high mountains in northern latitudes. Among the most remarkable are those of the east coast of Spitzbergen. The glaciers of Switzerland seem contemptible when compared to these, but present often a similar front into some lower valley. At times immense fragments break off and tumble into the water with an alarming splash. Frost sports wonderfully with these icebergs, and gives them majestic and singular forms. Masses have been seen assuming what an Arabian tale would scarcely dare to relate. Icebergs are the creation of ages, and receive annually additional height by the falling of snows, and of rain, which often instantly freezes, and more than repairs the loss occasioned by the influence of the sun.

ICELAND, one of the largest islands in Europe (being little inferior, in point of superficial extent, to Ireland), is situated in the north part of the Atlantic Ocean, between the 63d and 67th degrees of north latitude, and the 12th and 25th degrees of west longitude. Its extreme length from east to west is about 280 miles, and its breadth from north to south varies from 180 to 200.

History.

The precise period at which this island was discovered and first colonized is unknown; but, from the Landnamabok, an ancient Icelandic chronicle, and a work generally relied upon as authentic, we learn that the Norwegians were the first settlers upon its coasts. Naddodr, a famous pirate of that adventurous nation, was, on his return to the Feroe Islands from a predatory excursion, about the year 860, driven by a tempest upon the coast of Iceland. He ascended to the summit of a mountain, but observing around him neither the vestige of a human residence, nor aught else than vast and trackless fields of snow, he immediately abandoned it. Probably aware of this discovery, Gardar Svarfarson, a Swede, followed the same track a few years afterwards, and, succeeding in circumnavigating the country, discovered it to be an island. He there spent the winter, but finding little inducement to make it a permanent residence, he in the following spring returned to Norway. The third adventurer on this coast was one Floki, another celebrated Norwegian pirate, who, during two seasons, explored a considerable portion of the southern and western coasts. His attempt at forming a permanent settlement proved, however, like that of his predecessor, a failure; his cattle died, his expected crops were ruined, and, after experiencing numerous distresses and hardships from the inclemency of the weather, he determined to repair to a warmer region, and gave to the island at his departure the name by which it has ever since been known. That this name, and the report which he spread on his return, of the inhospitable nature of the island, were principally the effect of prejudice and disappointment, is evident from the contradictory account given of it by his companions, one of whom thought he could only convey an adequate idea of its richness and fertility by declaring that butter dropped from every plant.

These expeditions, though affording a slight knowledge of the country, would probably not have led to its colonization, had not disturbances in Norway induced some of the inhabitants of that country to quit their native soil. Harold Harfagra having subdued most of the petty princes of that country, put an end to the system of liberty and independence which the inhabitants of Norway had hitherto enjoyed; and thus drove many even of its nobility, with their families and dependents, from their homes. A body of these voluntary exiles, under the conduct of Ingolf, one of the discontented subjects, sailed from Norway, A. D. 874, from which year the Icelanders date the occupation of their island. When Ingolf approached the coast of Iceland, we are informed that he threw into the sea the wooden door of his former habitation in Norway; and finding it some time afterwards cast upon the shore at Reikiavik, he fixed his abode on the spot where the capital of the island now stands. He was followed by several others, and in a short time considerable portions of the southern and eastern districts of the island were taken possession of. Harold, it appears, did not at first oppose the emigration of his subjects; but afterwards finding it carried on to a great extent, he imposed a fine of four ounces of fine silver upon every person who should leave Norway to settle in Iceland. The Landnamabok, already mentioned, whose object was to afford a picture of the colonization of the island, describes with singular minuteness the arrival and spreading of the different settlers, and records, together with those of the Norwegians, the names of many Danes and Swedes, and even some Scotch and Irish, who at this period selected Iceland as their place of residence. The natural consequence of progressive colonization under the feudal tenure which was thus produced, was frequent contention between the new comers and those who had already settled in the country. To obviate these, a chief was named, under whose guidance and direction the concerns, interests, and feelings of the yet separate communities might be regulated and assimilated. This beneficial change was effected A. D. 928, and a republican form of government was thus established, well calculated to provide for the emergencies which gave it birth. We say a republican form of government; because, though there was only one supreme magistrate, who decided all disputes, and presided at the *all-thing*, or great general assembly of the nation, still he was elected to this office by the free choice of the people, and retained it no longer than while he preserved their confidence. This state of liberty the Icelanders enjoyed with uninterrupted harmony for the space of nearly 400 years. During this period, education, literature, and even the refinements of poetical fancy, flourished amongst them; and the well-known *sagas* or tales of the country, the most remarkable literary productions of that dark age, were principally penned prior to the fourteenth century.

The ancient Icelanders possessed, as is still the case with their posterity, few of the luxuries or refinements of life; and were occasionally exposed to severe privations, from the nature of their soil, and the seasons under which they lived. There is reason, however, to believe, though the fact cannot with perfect accuracy be ascertained, that the climate of Iceland was once less austere than it now is, and that not only trees and shrubs, but even corn, were grown upon the island. Of the ancient existence of the former, the trunks occasionally discovered in the bogs afford pretty satisfactory evidence. Corn of any description is not now a native of the island; and a few birch twigs afford the only approach towards timber. Like the present inhabitants, the ancient Icelanders were much dispersed over the country, their habitations being seldom grouped together, but placed wherever the situation and nature of the soil appeared suitable. Their occupations and modes of life appear also to have borne much similitude. The produce of the farm, and the capture of fish, afforded them, as they do their posterity, the principal means of subsistence; and their traffic with foreign countries made a valuable addition to their domestic comforts. The moral habits of the people were good, though, prior to the introduction of Christianity, in the year 1000, they were blended with superstition and some unnatural customs, such as the exposure of their infants. The putting down of heathenism is not the least remarkable event in the early history of Iceland. Frederic, a bishop of Saxony, was the first who preached Christian doctrines in this distant land. The propagation of his tenets, however, met

Iceland. with every species of opposition; but the numbers who adopted them gradually increased so considerably, that the national assembly which met at Thingvalla in the year 1000 took the matter into consideration. Whilst the question was warmly debated, the story told is, that a messenger hurried into the assembly and announced that fire had burst from the earth in the southern part of the country, and was carrying destruction before it. The heathen party instantly exclaimed that this was the vengeance of the gods against the presumption of their opponents. But Snorro, who was a zealous advocate for the Christian cause, immediately demanded, "For what reason was the anger of your gods kindled when the very rock was burning on which we stand?" Thingvalla being in the midst of a volcanic country, and precipitous cliffs of lava surrounding the place of public assembly. The promptitude of the reply had the desired effect, and ultimately procured a decision in favour of the Christians. On the promulgation of Christianity, all religious contest was suspended; the whole people espoused the new faith; and a church establishment was soon afterwards formed. The Icelanders appear to have equalled the blindest of their fellow Catholics in their attachment to the hierarchy; and it was not till the year 1551 that the Reformation, under Christian III. of Denmark, found its way into the island. Since that period the form and ceremonies of the Icelandic church have been strictly Lutheran, though, from the poverty of the country, their churches are in general extremely wretched, and the pittances allotted to their clergy still more so.

But to return to earlier periods. We are indebted to the enterprise of the ancient inhabitants of Iceland for the discovery both of Greenland and Newfoundland. A mariner named Eric accidentally approached the former of these countries about the year 972, and was so delighted with his discovery, that he gave it the name which it still bears. His flattering accounts of the country had the desired effect of alluring his countrymen to its shores; and in this he so far succeeded, as in a short time to form an extensive and thriving settlement. The colonists maintained a constant commercial intercourse with Iceland and Norway; and the records of the settlement come down uninterruptedly to the beginning of the fifteenth century, when at once every trace and vestige of it was lost. The causes of this singular fact have never yet been fully ascertained, although the most probable supposition is, that an accumulation of ice took place about this time on the Greenland coast, which prevented the access to it by sea. The breadth of the sea between the two countries does not exceed 100 miles; and yet the fate of this ancient colony, commonly called by distinction Old Greenland, is quite unknown. The northern shores of America were first known from Biono Heriolforn, a native of Iceland, being driven upon them during a voyage to Greenland in 1001. Attracted by the account of this discovery, Leif, another enterprising navigator, pursued the same route considerably farther southwards, and finding an agreeable and pleasant country, he wintered there, giving it, from the circumstance of wild vines growing on it, the appellation of Vinland. This was subsequently, to a partial extent, colonised by the Icelanders; but few particulars are known of their progress, and what ultimately became of the colony is now a mere matter of speculation.

The independent and happy state of Iceland was not destined to be uninterrupted. About the year 1250, party disputes and internal feuds arose, which the ambition of the mother country enabled Haco, the then king of Norway, to foment. In 1261 a formal proposal was consequently made in the national council, to submit to that sceptre; but in doing so, the Icelanders stipulated that they should be allowed to retain their ancient laws and privileges, that they should be exempt from taxes, and that the annual importation of the most necessary articles of foreign produce should be secured to them. For upwards of a century Iceland was under the dominion of Norway, without any occurrence taking place of the slightest importance; and when in the year 1380 that country became subject to Denmark, the island was transferred to the same power, without tumult or opposition. The change in the constitution of the island, from its annexation to a European monarchy, naturally produced a corresponding change in the character and habits of the people. Not that the foreign yoke was a tyrannical one, otherwise a portion at least of the ancient vigour and activity of the inhabitants would have displayed itself in occasional acts of insurrection. On the contrary, the Danish monarchs not only exercised their sway with a lenient and forbearing hand, but paid much attention to the welfare and the wants of this remote part of their dominions; and thus repose and security succeeding to internal broils, produced a state of comparative apathy and indolence. Rank and property became more nearly equalized, and the trade of the country was gradually transferred to the natives of other kingdoms. A plague which devastated the island in 1402, and carried off, it is said, nearly two thirds of the whole population, tended still further to depress the spirit of the people, and destroy the strength and prosperity of the country. The reformation of religion, which, as above stated, took place in Iceland in the year 1551, was the first dawn of an improvement amongst the natives, which the introduction of printing and the establishment of a press about the same period aided greatly in extending. The recent history of Iceland is principally characterised as a record of physical calamities, which, from 1707, when the ravages of the small-pox carried off sixteen thousand of its inhabitants, down to 1753 and 1759, when the inclemency of the seasons created the most dreadful and distressing famines, and lastly, the memorable year 1783, when the great eruption from the Skaptaa Yokull took place, have rarely ceased in one form or another to devastate the island. The scene of this last-mentioned eruption is amongst lofty mountains in the interior of the island, known only to the natives by the remote view of their snow-clad summits. From this desolate and unfrequented region, Sir George Mackenzie remarks, vast torrents of lava issued forth, overwhelming all before them, and filling up the beds of great rivers in their progress towards the sea. For more than a year, a dense cloud of smoke and volcanic ashes covered the whole of Iceland, extending its effects even to the northern parts of continental Europe; the cattle, sheep, and horses of the country were destroyed; a famine, with its attendant distresses, broke out amongst the inhabitants; and the small-pox invaded the island at the same time, with its former virulent and fatal effects. From these combined causes, more than eleven thousand people perished during the period of a few years; an extent of calamity which can only be understood, by considering that this number forms nearly a fourth part of the whole population of the country. The destruction of the fishery upon the southern coasts of the island by these volcanic eruptions was another more permanent source of distress, and one which is not even now fully removed.

Government, laws, &c.

The government of Iceland is committed to an officer appointed by the crown of Denmark, who is occasionally a native of the island, but more frequently a Dane by birth. This supreme magistrate has the title of Stiftamtman, and is intrusted with a general superintendence of every department. Under him are the amtmen or provincial governors, each of whom rules one of the four provinces of the island, and possesses a similar jurisdiction over his respective quarter, as his superior officer does over the whole island. Each province again is divided into syssels or shires, over which the sysselmen preside. This office is likewise in the appointment of the crown; and, on account of its importance, it is always given to one of the most respectable landed proprietors within the district. The rank of sysselman corresponds in some degree to that of sheriff in this country. The hreppstiore is a subordinate parochial officer, whose duty it is to attend to the condition of the poor, and to assist the sysselman in the preservation of the peace. He is usually chosen from among the farmers; whilst the forlikunarmen are those appointed as arbiters for the decision of disputes among the parishioners. The laws of Iceland, like the general form of government as established nearly six hundred years ago, have undergone little important alteration; but the judicial changes have been more considerable, and the forms of justice in most respects now resemble those of Denmark.

Crimes are rare; the gentle and peaceable disposition of the natives, their moral and religious education and sober habits, act as preventives of such as are of a flagrant description. Small thefts, especially of sheep, are the most frequent; but the high court has seldom to decide more than six or eight cases annually. The whip is the only punishment applied in the country, excepting fines; those who are punished with hard labour or banishment being sent to Copenhagen.

There are about 194 parishes or livings on the island; but the clergy number at least 300, as many of the parishes have two churches, the great distance and the danger of travelling, particularly in winter, when the rugged fields of lava are covered with snow, making it frequently impossible for all the peasantry of the same parish to attend at one church. The clergy are partly supported by a species of tithes, which are mostly paid in kind. These stipends, however, are extremely miserable; the largest in the island not exceeding 185 dollars, and the average being little above 35 dollars, or L.6 sterling, per annum. They must therefore depend almost entirely for subsistence on their glebe land and their stock of cattle, and a small pittance they are entitled to for the few baptisms, marriages, and funerals that occur among their parishioners. "The clergy," observes Mr Barrow, "almost universally submit to every species of drudgery from necessity. Their incomes are too small to allow them to hire and feed labourers; and nothing is more common than to find the parish priest in a coarse woollen jacket and trousers, or skin boots, digging peat, mowing grass, and assisting in all the operations of haymaking. They are all blacksmiths also from necessity, and the best shoers of horses on the island. The feet of an Iceland horse would be cut to pieces over the sharp rock and lava if not well shod. The great resort of the peasantry is the church; and should any of the numerous horses have lost a shoe, or be likely to do so, the priest puts on his apron, lights his little charcoal fire in his smithy (one of which is always attached to every parsonage), and sets the animal on his legs again." Their poverty was quaintly but very contentedly alluded to by one of themselves, when he said, in a few lines he composed on occasion of Mr Henderson's visit to his mansion:—"Ever since I came into the world I have been wedded to poverty, who has now hugged me to her bosom these seventy winters all but two; and whether we shall ever be separated here below, is only known to Him who joined us together."

The clergyman of the parish having thus to undergo the same toils and hardships as the most humble of his flock, and enjoying no superior comforts or refinements, must feel that it is by his intellectual attainments only he can retain that station, and command that respect from his parishioners, which it is so necessary for him to possess. Literary pursuits are therefore the principal occupation of the clergy during the long and dreary period of winter; and it is astonishing, considering the difficulties in their way, the progress most of them have made. The history and literature of the more refined nations of Europe now form a part of their studies. The English language, in which they find so many words of their own, and so many borrowed from the Latin, is cultivated by many of the clergy. The German they find still more easy; the Danish and Norwegian languages approximate to their own; and many of the choicest works in all these dialects have been translated into Icelandic. The present state of literature in Iceland thus appears to be of a different description from what it was in ancient times. Its supposed decline is the subject of general complaint, though in point of fact it has only changed its character from the heroic and romantic to the useful and intelligible. Von Troil, in comparing the state of the sciences in the island to the four stages of human life, remarks that "their infancy extended to the year 1056, when the introduction of the Christian religion produced the first dawn of light. They were in their youth till 1110, when schools were first established, and the education and instruction of youth began to be more attended to. Their manly age lasted till about the middle of the fourteenth century, when Iceland produced the greatest number of learned men. Old age appeared towards the end of this same fourteenth century, when the sciences gradually decreased, and were almost entirely extinct, no work of any merit appearing. History now drooped her head, poetry had no relish, and all other sciences were enveloped in darkness." But a new dawn of knowledge spread rapidly over the island after the Reformation; and the introduction of the printing press produced the same beneficial effects in Iceland as in other parts of Europe. A very important change took place in the nature of the studies pursued; and the clergy in particular, instead of occupying their time in making and transcribing *eddas* and *sagas*, that is, political and historical romances, have turned their attention to sober history, to the collection and registration of events, and to other literary productions of more intrinsic value, which the printing press, still actively employed on the small island of Vidoe, opposite Reikiavik, affords them the opportunity of turning to account.

There are no public hospitals, or charitable institutions of that description, on the island; the sick and the poor being almost wholly supported by their own families. Indeed a sort of disgrace attaches to those who send them away to be taken care of by strangers, even though maintained at their own expense. On the other hand, there is an important collegiate school at Bessestad, which may well be considered as the only public institution of importance in the country. It is intended principally for the education of young men destined for the church, and is attended by about forty scholars. There are three masters, the one, professor of theology, instructs the pupils in Hebrew and Greek, as far as the Greek Testament, and Xenophon; the second, who is the lecturer, teaches them Latin, history, mathematics, and arithmetic; and the third the Danish, Norwegian, German, and Icelandic languages. Their attendance is constant from October to May, the intermediate months being the period of vacation, when the students go to their several homes. The funds appropriated for this excellent institution are said to be sufficient to pay the teachers, and to afford board, books, and clothing to the scholars gratis.

Property is held either of the crown or in fee simple; the crown lands and many others are let to farmers, on what may almost be called perpetual leases. The rent is paid in two parts; the land rent, fixed at an old valua-

Iceland. tion, which it has not been found necessary to alter, and a rent for the number of cattle which it is calculated the farm is able to support; and these are transferred from one tenant to another, each succeeding one taking them, and leaving a similar number on quitting the farm. This, however, does not prevent a farmer keeping as much stock as he can maintain, without paying an additional rent. The tenant is for life, provided he does not injure the farm; but he may quit whenever he pleases, on giving six months' notice. His rent is generally paid in produce, on the coast in fish, in the interior in wool, tallow, butter, sheep, &c. or, according to agreement, in money. Individuals who cultivate their own properties, and tenants who are in easy circumstances, generally employ one or more labourers, who, besides board and lodging, have from ten to twelve dollars of annual wages. In Iceland, as in Norway, there is no such thing as entailed property, and the law of descent excludes primogeniture. If an individual dies intestate, his estate is sold or valued, and divided amongst the children, so as to give equal shares to the sons, and half shares to the daughters. If, however, any of the brothers can pay the shares to his brothers and sisters, it is generally arranged that the freehold estate be made over to him, in order to retain it in the family.

Population. The gross population of Iceland is about 53,000, a very scanty proportion for an island whose surface is to that of Ireland as four to five; but that surface, it is true, from its nature, and the character of the climate, is perhaps as unfavourable as any which exists between the limits of the two arctic circles. Deducting the areas of the numerous fiords with which it is intersected, the square contents of the land may be calculated at 37,388 statute miles; but as the centre of the island consists entirely of snowy and uninhabited mountains, the peopled portion cannot be considered more than 25,000 square miles; and the population therefore will not much exceed two persons on each square mile. The number of births in the year 1832 was 2516; and the number of deaths during the same year amounted to 1390, of which 784, considerably more than one half, were children under ten years of age. The whole population is employed either in farming, which occupies about three fourths of them, or in fishing. Other employments do not exist, nor is there any other class of people or townsmen, save the small number of merchants in Reikiavik and the other trading establishments. Every branch of industry is therefore domestic, and confined chiefly to articles of clothing, such as coarse cloth, gloves, mittens, and stockings. The peasantry are generally ingenious, and manufacture such simple pieces of furniture as their cottages require; some also aspire to make trinkets of silver, and articles from the walrus tusks. The trade of Iceland has never been managed in a way to be of important benefit to its inhabitants, those who are engaged in it being almost exclusively Danes, and other foreigners. Of late years, however, there has been an annual export of from 1,000,000 to 1,200,000 pounds of raw wool, besides about 200,000 pairs of knitted stockings, and 300,000 mittens, or gloves without fingers. The Iceland sheep have remarkably fine fleeces of wool, which the farmers in the spring of the year take off whole; their weight being usually from four to five pounds. The other exports of Iceland are dried fish, salted cod, and other species, for the quality of which the fishing banks of the island are celebrated, but which latterly have been much invaded by the French and Dutch fishermen, to the great grievance of the nation. Fish-oil, whale-blubber, skins, eider-down, feathers, and the *lichen Islandicus* for medicinal purposes, may also be included amongst their list of exports. These the natives dispose of to the Danish merchants in exchange for coffee, sugar, tobacco, snuff, a small quantity of brandy, rye and rye-bread, biscuit, wheaten flour, salt, soap, and such other small articles as are in constant use for domestic purposes. Those who can afford it purchase a supply of linens and cottons, which of late years have become of more common use, and which must tend greatly to cleanliness, and the prevention of those diseases which woollen clothing worn next the skin tends to engender. The traffic thus occasioned takes place in the early part of summer, and whilst it lasts creates a kind of fair, with no little bustle and business, in the capital. All the articles brought from the interior for sale at the sea-ports, and all those taken back for winter consumption, are transported on pack-horses. There is not, in fact, in all Iceland such a machine as a wheel-carriage; and indeed if there were, they would be useless, as there is nothing in the shape of a road on which they could move.

The Icelanders are generally middle sized and well made, though not very strong. Their manners are exceedingly simple, and they are very respectful as well as obliging to strangers. Though their poverty disables them from imitating the hospitality of their ancestors in all respects, yet they cheerfully give away the little they have to spare, and express the utmost satisfaction if the gift shall have proved acceptable. They possess but few peculiar customs, and those not of particular interest. Their sole occupation during summer is to provide means of subsistence for the winter season; and when confined during the dreariness of an arctic winter to their huts, their great source of amusement is the tales of olden times, when the learning of their country rendered it renowned in every quarter of Europe. "Being of quiet and harmless dispositions," says Sir George Mackenzie, "having nothing to rouse them into a state of activity, nothing to inspire emulation, no object of ambition, the Icelanders may be said merely to live. But they possess innate good qualities, which, independently of the consciousness of their former importance, have preserved their general character as an amiable community. They have indeed become negligent with respect to the cleanliness of their persons and dwellings, but they deserve a high place in the scale of morality and religion. To religious duties they are strictly attentive; and though the clergy are not generally raised above the level of the peasantry in any respect but in their sacred office, yet they have been able to preserve the regard due to those who are considered as peculiarly the servants of the Supreme Being." The poor Icelander, too, is strongly attached to his native soil, and, like the Swiss, has been known to throw up lucrative appointments which he held elsewhere, for the sake of rejoining his family and friends on the island, being never so happy as when he sees a prospect of returning to it.

Topography. Few countries in the world present a more forbidding aspect, or have less apparently to invite the approach either of the traveller or the merchant, than Iceland. The appellation given it by its first discoverers seems still peculiarly its own; and if the statement be accurate, of its having in former days grown considerable forests, whilst now scarce a shrub will rear its head, there is little probability of that name ever being belied. "Imagine to yourself," says Von Troil, "a country which, from one end to the other, presents to your view only barren mountains, whose summits are covered with eternal snow, and between them fields divided by vitrified cliffs, whose high and sharp points seem to vie with each other to deprive you of the sight of a little grass, which scantily springs up among them. These same dreary rocks likewise conceal the few scattered habitations of the natives, and nowhere a single tree appears which might afford shelter to friendship and innocence. The prospect before us, though not pleasing, was uncommon and surprising. Whatever presented itself to our view bore the marks of devastation; and our eyes, accus-

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tomed to behold the pleasing coasts of England, now saw nothing but the vestiges of the operation of a fire, Heaven knows how ancient." Nor does Reikiavik, the capital of the country, the residence of the governor, the centre of its trade, present a much more inviting prospect to a stranger on his arrival. "He perceives," says Mr Barrow, "only a long row of houses, or rather the upper parts of houses, running parallel to and close behind a rising beach of a black shingle, their red or brown roofs being the most conspicuous, and the tops of the doors only, and perhaps about half of a row of windows, peeping above the said beach; but he sees enough of them to satisfy himself that they are of a low, mean character. On each extremity of this line of houses he will observe a rising eminence, scarcely deserving the name of a hill, on which he will perceive a number of sod or turf huts, raised a little, and but a little, above the level of the ground; their roofs, and generally their sides too, verdant enough and well clothed with grass, the abodes chiefly of fishermen, labourers in the merchants' employ, and idlers, of which there are not a few sauntering about. Among these hovels, or rather above them, on the western eminence, stands conspicuously the house of the physician-general of Iceland, or perhaps more properly surgeon and apothecary of Reikiavik; for he acts in all these capacities; which tall building, speaking comparatively with its neighbours, is kept in countenance by a still taller one, the only windmill on the island." "The lower part of their turf huts is built of rude stones to the height of about four feet, and between each row layers of turf are placed with great regularity, to serve instead of mortar, and in fact to keep out the wind. A roof of such wood as can be procured rests upon these walls, and is covered with turf or sods. A window is a luxury; a cask or barrel, with the two ends knocked out, answers the purpose of a chimney; but the smoke is frequently allowed to escape through a hole in the roof. The only fire ever burnt within their walls is that of the kitchen, which forms a small separate apartment, frequently detached."

The surface of the country is for the most part highly mountainous and rugged; some of the yokuls or snow-capped eminences, as the Snaefell, the Skaptaa, Kateja Torsa, and Hecla, rising to the height of from 4000 to 6000 feet above the sea. The centre of the island, however, is traversed by considerable plains, some of which are covered with tolerable pasture, whilst others form extensive wastes, morasses, and fields of lava. It is also watered by a number of large rivers, which, from the rapid melting of the snows in summer, present a turbid, and some of them so white an appearance, that they are denominated from that circumstance. The smaller streams which rise in the lower grounds are however transparent, and are celebrated for the abundance and beauty of the salmon which frequent them. There are also a number of lakes, of which the principal are called Thingvalla Vatn, an expanse of water from ten to fifteen miles in length, and six to eight in width, on whose banks the great assemblies of the nation used to be held; My Vatn, in the north-eastern extremity of the island; and Fiske Vatn, a lake so designated from the fine fish it affords to the inhabitants of the midland districts.

The coast, like that of Norway, is in every direction deeply indented with creeks and arms of the sea; few of them, however, afford safe anchorage; and along the southern coast, eastward from where the great river Elvas empties itself into the sea, there are extensive shoals, formed partly, no doubt, by the depositions of the rivers proceeding from the great range of yokuls to the eastward of Mount Hecla, but principally from the remains of volcanoes, which, like the Sabrina and Graham Islands, have at one period appeared above the surface, but from the action of the waves have subsequently sunk below it. It is extremely probable that Iceland owes its origin to some great convulsion of nature; for no part of the globe presents such a number of volcanic mountains, so many boiling springs, or such immense tracks of lava. The frequent and long-continued eruptions of its volcanoes are all on record in the historical annals of the island; their number since the year 1004 is stated at sixty-five. Of Hecla no less than sixteen great eruptions are mentioned; but, with the exception of that in 1818, this celebrated mountain has been in a quiescent state since the middle of last century. By far the most dreadful occurrence of this description was that already mentioned, which took place from the great range of the Skaptaafell Yokul in the year 1783; an eruption which devastated the finest portion of the island, and produced famine and disease amongst its inhabitants to an extent scarcely credible.

Geysers.

The boiling springs of Iceland have long attracted the attention of scientific men, and they are assuredly amongst the most curious and most remarkable phenomena which it presents. These are very numerous in many quarters of the island; but it is to the fountains termed the Geysers that we would now particularly allude. These extraordinary springs are situated in the western part of the island, in a small plain sixteen miles north of the village of Skalholt. The siliceous depositions of the waters of the Great Geyser have formed for it a basin about fifty-six feet in the greatest diameter, and fifty-two in the narrowest, a projection from one side causing the circumference to deviate from a perfect circle. A mound has thus been produced, which rises considerably above the surface of the plain, and slopes on all sides to the distance of a hundred feet or thereabouts, from the borders of the basin on its summit. The basin is from four to five feet deep, and slopes a little, like a saucer, towards the centre. At this point there is a cylindrical pipe or tube, about twelve feet in diameter and seventy feet deep, up which the boiling water rises and the eruptions burst forth. At intervals of some hours, when the basin is full, explosions are heard from below like the distant firing of cannon, and at the same time a tremulous motion of the ground is felt around the basin. "We observed," remarks Sir John Stanley, "the water in the basin to be much agitated; it boiled violently, and heaved as if some expansive power were labouring beneath its weight, and some of it was thrown up a few feet above the basin. Again there were two or three shocks of the ground, and a repetition of the same noise. In an instant the surrounding atmosphere was filled with volumes of steam rolling over each other as they ascended, in a manner inexpressibly beautiful, and through which columns of water shivering into foam darted in rapid succession to heights which at the time we were little qualified to estimate, but afterwards ascertained by means of a quadrant to be about ninety-six feet. At last, the water having filled the basin, it rolled in great waves over its edge, and forming numerous rills, made its way down the sides of the mound. Much was lost in vapour also, and still more fell to the ground in heavy showers of spray. The intervals at which the several jets succeeded each other were too short for the eye to distinguish. As they rose out of the basin, they reflected by their density the purest and most brilliant blue. In certain shades the colour was green, like that of the sea; but in their farther ascent all distinction of colour was lost, and the jets, broken into a thousand parts, appeared white as snow. Several of them were forced upwards perpendicularly; but many, receiving a slight inclination as they burst from the basin, were projected in beautiful curves, and the spray which fell from them, caught by a succeeding jet, was hurried away still higher than it had been perhaps before. The jets were made with inconceivable velocity, and those which escaped uninterrupted terminated

Iceland. in sharp points, and lost themselves in the air." After continuing for some minutes, the explosions cease, when the pipe and basin are both found empty.

Such are the phenomena presented during an eruption of the Great Geyser. In external appearance, as well as in the magnitude and violence of its ejections, this Geyser differs materially from the other two principal springs in its vicinity. Indeed, although it has been satisfactorily ascertained from historical records that they have been playing for the last six hundred years, yet very material changes are evidently taking place from time to time amongst them. One which Sir George Mackenzie mentions as being particularly active when he visited the island in 1809, and whose eruption Sir John Stanley describes as incessant, is now, by Mr Barrow's account, extinct; and the surface of the neighbourhood has been so totally altered, that it is with difficulty the accounts of recent travellers can be made to coincide with those at the commencement of the century. It is admitted, however, that the phenomena they all exhibit are occasioned by the production and confinement of steam in cavities, so formed, that when the accumulation arrives at a certain point, the pressure of the water opposing its escape is overcome, and the water is thrown out before it. The siliceous incrustations which are formed around the brim of the basin, and along the edge of the streamlets running out of it, are not the least remarkable productions of the Geyser. They consist of little tufts or knobs, grouped in such a manner as to bear a resemblance to the heads of cauliflowers; of so delicate a texture, however, that it is almost impossible to remove them in a perfect state. This deposit is principally formed from the condensed steam or vapour. The sides of the tube and the bottom of the basin, on the contrary, are, doubtless from the constant friction of the water, perfectly smooth, and as hard as agate.

Another very remarkable hot spring is the mud volcano of Reykialid, near Myvatn, towards the north-eastern extremity of the island. This occupies the crater of Mount Krabla, one of the principal volcanoes of Iceland, and is thus described by Henderson, who made the circuit of the island during the year 1815. "At the bottom of a deep gulley lay a circular pool of black liquid matter, at least three hundred feet in circumference, from the middle of which a vast column of the same black liquid was erupted with a loud thundering noise. This column is equal in diameter to that ejected by the Great Geyser at its strongest eruptions. The height of the jets varies greatly, rising on the first propulsions of the liquid to about twelve feet, and continuing to ascend, as it were, by leaps, till they gain the highest elevation, which is upwards of thirty feet, when they again abate much more rapidly than they rise; and after the spouting ceases, the situation of the aperture is rendered visible only by a gentle ebullition, which distinguishes it from the general surface of the pool; the eruptions take place every five minutes, and last about two minutes and a half." In the same vicinity are the hot springs of Husavik, which, though they bear no comparison in magnificence to those of Skalholt, are extremely interesting in many respects. The pipe of one of them, the Oxahver, which is said to have derived its name from the circumstance of an ox having fallen into it, is about eight feet in diameter, is surrounded with a strongly incrusted brim, and shortly below the surface trends to one side, and becomes quite irregular. Its jets rarely exceed twenty feet in height, but, according to Henderson's account, they are conducted with the utmost regularity in point of time. It was amongst the beautiful incrustations formed around the basin of this spring that Mr Rose of Edinburgh, during his mineralogical excursion a few years ago, observed that variety of apophyllite, to which the synonyme of Oxahverite was subsequently applied.

Though it cannot be denied that these springs have some communication with the volcanoes which abound in the island, yet it is a remarkable fact that they are seldom found very near them, although dispersed throughout the whole country. They possess unequal degrees of heat, ranging from 188° to 212°, and are generally devoid either of taste or smell, although the flavour of sulphur is occasionally perceptible. When their situation suits, they are turned to good account by the inhabitants, both as bathing quarters, and for various culinary purposes, in boiling fish, evaporating sea-water, and the like. At Reikholt there is a celebrated bath of this description, which was constructed six hundred years ago by the famous Snorro Sturleson. It is fourteen feet in diameter and six feet deep, being supplied, by means of covered conduits, both with hot and cold water, from springs about a hundred yards distant, so that any desired temperature might be obtained.

The contents of the Geyser water Dr Black ascertained to be, in 10,000 grains, or about one sixth of a gallon, of watcr,

Soda	0·95 gr.
Alumina	0·48
Silica	5·40
Muriate of soda	2·46
Dry sulphate of soda	1·46
Total	10·75

Geology. Though Iceland has been visited at different periods by several scientific men, little is comparatively known either of its geology or its mineralogy. To Sir George Mackenzie the world is indebted for a pretty minute description of the mineral products of the south-western portion of the island;[1] but of the east coast, which has long been celebrated for its magnificent zeolites and splendid calcedonies, little has as yet been made public. The island, from one extremity to the other, exhibits undoubted demonstrations of volcanic origin; immense tracks of lava, extensive beds of tuff, basaltic columns, greenstone, and amygdaloid, appear in succession at every step. The surfaces of some of the lavas which Sir George Mackenzie observed in Iceland he describes as not unlike coils of ropes or crumpled cloth; in other respects they appear to resemble the lavas of recent volcanoes elsewhere, being, like those of Ætna, thrown up into large flattened masses. These, it is well known, are produced by the formation of a crust on the lava during its course, which, as it accumulates, breaks through the hardened surface; and thus, when it cools, leaves a wide extended plain of the most rugged and impassable description. In some places the surface has swelled during the course of the lava into knobs, from a few feet in diameter to forty or fifty, many of which have burst, and disclose caverns lined with melted matter in the form of stalactites. Of these some remarkable instances are mentioned amongst the extremely rugged lava of Buderstad, in the vicinity of the Snaefell Yokul, where several of the caverns extend to the depth of forty yards. Stappen, in the same part of the island, presents, for the extent of about two miles, the most striking columnar appearances, both in the cliffs which form the shore, and in the numerous insulated rocks which appear at different distances from the land. In general, the ranges of columns assume a vertical position, and an elevation of about fifty feet; but in some places

[1] The Museum of the Royal Society of Edinburgh is enriched by an extremely interesting suite of minerals, collected by Sir George Mackenzie in this part of Iceland, and presented by him to the Society.

Iceland.

they are disposed indiscriminately upon one another in bundles, and in several instances appear diverging from a centre. Sir John Stanley describes a cavern on this coast which his party rowed into, as more curious even than the cave at Staffa; the columns, which were very lofty, diverging considerably from the roof towards the base. Frequently these columnar basalts are associated with or imbedded in tuffa, a volcanic production of the most universal occurrence. "Lava and tuffa," says Sir George Mackenzie, "are sure indications of each other. The mountains of the Guldbringé Gyssel are almost entirely composed of tuffa. The hills round Mount Hecla, near the Snaefell Yokul, and in the neighbourhood of every lava I met with, consist of that substance; in fact, it appears to be the predominant rock." Amygdaloid forms the larger portion of the eastern extremity of the island, and it is imbedded in this that those splendid specimens of calcareous spar *par excellence* denominated Iceland-spar are found. This rock is likewise the matrix of all the different varieties of the zeolite tribe, of the magnificent calcedonies, and in fact of most of the fine minerals which have long rendered Iceland so celebrated a locality among collectors. Fossilized wood is found in several places; that variety termed Surturbrand is peculiar to the north-eastern volcanic district. It is remarkable that the specimens hitherto brought home of this last substance appear to be oak. It burns with flame, and can be cut and shaped like jet; but from its brittleness does not admit of being sliced into shavings. Pumice, obsidian, and other volcanic minerals appear in great beauty in many districts of the island, particularly near Hecla, and to the north of Krabla.

Zoology.

There is little remarkable in the zoology of Iceland. The only wild animals are foxes, which in some parts of it are very numerous, and do much damage to the farmers in destroying their lambs and other produce. Rein-deer were introduced from Sweden about the middle of last century, and have since increased and run wild. The Iceland horse is small, but hardy, active, and capable of sustaining considerable fatigue. Dogs and cats they have in abundance, and rats and mice are proportionally numerous. The floating ice occasionally transports a polar bear or two from the Greenland coasts during spring, which, however, are no sooner heard of than the neighbouring country are up in arms to kill them, and they are consequently hunted down and destroyed without mercy. The skins of the foxes, particularly those of the blue species, are valued as an article of commerce.

Amongst the land-birds of the island are the sea-eagle or erne, a very destructive bird among the eider-ducks; the falcon, which used formerly to be a valuable item in the exports of the island; and the raven, which is a larger and more powerful bird than those of Britain, frequently pouncing upon and carrying off young lambs, and destroying poultry; it is met with in great numbers, particularly on the cliffs near the sea-coast. The ptarmigan, snipe, golden plover, wagtail, and curlew, are well known. Water-fowl of every description, common to northern latitudes, are met with on the coasts and in the lakes. Of these the most valuable to the inhabitants is the eider-duck, which is strictly preserved, a penalty of half a dollar being exigible for shooting one of these birds. From this circumstance they become so remarkably tame, especially in the breeding season, that they frequently make their nests close to the houses, and in spots which have been prepared by ridges of stones artificially built up for them; and in such places, during the process of incubation, it is not unusual for the female to remain on the nest, and suffer herself to be fondled. The lining of their nests, being the downy substance plucked off their own breasts, is taken away, even a second and third time, until the poor bird has plucked herself nearly naked. Their eggs, too, are removed once or twice, and are eaten in the same manner as plovers' eggs. Swans are very numerous in some of the lakes of the central part of the island, where they remain unmolested until the ice sets in, when they betake themselves to the sea-shore. The eggs, the feathers, and the down of this fine bird, like those of the eider-duck, supply the peasantry with an article of food, and also of commerce.

The vegetable productions of the island, as already stated, are the reverse of luxuriant. With the exception of a few stunted birch, rarely above six feet high, and some dwarf willows, in the southern and eastern districts, nothing in the shape of a tree occurs; and, even in the sheltered situations afforded by the gardens surrounding the merchants' houses near Reikiavik, all attempts to raise the most common culinary vegetables occasionally fail. Even in good years, Dr Hooker remarks that in many of these little enclosures the cabbages were so languid and small that a half-crown piece would have covered the whole of the plant. It is a curious fact, however, that timber has in former periods grown in more abundance, as is evident from the logs so frequently met with in the morasses and peat-bogs of the country. These the peasants are in the habit of extracting and using for fire-wood. The Surturbrand, already mentioned, has nothing to do with the antediluvian state of the island.

The scanty produce of the land is, however, to a great degree compensated for by the abundance of fine fish which occurs on the coast. In several parts of the island, particularly on the north and north-west, the shark fishery is a regular occupation. Strong hooks fastened to chains are baited and anchored a little way out to sea, and the fish when caught are thus towed to shore. Of the skin shoes are made, a considerable quantity of oil is extracted, and some parts of the flesh are occasionally smoked and used by the natives for food. The cod is very plentiful; the haddock grows to a large size; ling, skate, flounders, and halibut are likewise very common; the herring, too, frequents the fiords in vast shoals, but this branch of the fishery has hitherto been little attended to. The salmon in the rivers are said to be very fine, and no country in the world produces them in greater quantity. Seals are particularly numerous on the shores of the Breide-fiord and the western coast.

Such is a rapid sketch of the most remarkable features of Iceland. The ardour, however, with which the sciences of natural history and geology are now pursued in Britain, coupled with the increasing facility every year afforded by means of steam navigation, will no doubt, in the course of a very few summers, present us with more minute and more accurate information respecting the truly extraordinary natural productions of this wild but wonderful island.

(See *Letters on Iceland*, by Von Troil, in 1772; *Travels in Iceland*, by Sir George Mackenzie, in 1810; *Journal of a Residence in Iceland during the Years* 1814 *and* 1815, by Ebenezer Henderson; and *Visit to Iceland in the Summer of* 1834, by John Barrow, Esq. Jun.)

ICENI, the ancient name of the people of Suffolk, Norfolk, Cambridgeshire, and Huntingdonshire, in England.

ICHNOGRAPHY, in perspective, the view of any thing cut off by a plane parallel to the horizon, just at the base of it. The word is derived from the Greek ἰχνος, *footstep*, and γραφω, *I write*, as being a description of the footsteps or traces of a work. Amongst painters it signifies a description of images or of ancient statues of marble and copper, of busts and semibusts, of paintings in fresco, mosaic works, and ancient pieces of miniature.

ICHNOGRAPHY, in *Architecture*, is a transverse or horizontal section of a building, exhibiting the plot of the whole edifice, and of the several rooms and apartments in any storey, together with the thickness of the walls and partitions; the dimensions of the doors, windows, and chimneys; and the projectures of the columns and piers, with every thing visible in such a section.

ICHOR properly signifies a thin watery humour like serum, but is sometimes used for a thicker kind flowing from ulcers, called also *sanies*.

ICHTHYOCOLLA, Isinglass, a preparation from the fish known by the name of *huso*. The word is Greek, formed of ἰχθυς, *fish*, and κολλα, *glue*. The method of making isinglass was long a secret in the hands of the Russians. The following account of it was published by Mr Humphrey Jackson, in the 63d volume of the Philosophical Transactions.

"All authors who have hitherto delivered processes for making ichthyocolla, fish-glue, or isinglass, have greatly mistaken both its constituent matter and preparation. To prove this assertion, it may not be improper to recite what Pomet says upon the subject, as he appears to be the principal author, whom the rest have copied. After describing the fish, and referring to a cut engraved from an original in his custody, he says, 'As to the manner of making the isinglass, the sinewy parts of the fish are boiled in water till all of them be dissolved that will dissolve; then the gluey liquor is strained, and set to cool. Being cold, the fat is carefully taken off, and the liquor itself boiled to a just consistency, then cut to pieces and made into a twist, bent in form of a crescent as commonly sold; then hung upon a string and carefully dried.'

"From this account, it might be rationally concluded that every species of fish which contained gelatinous principles would yield isinglass; and this parity of reasoning seems to have given rise to the hasty conclusions of those who strenuously vouch for the extraction of isinglass from sturgeon; but as that fish is easily procurable, the negligence of ascertaining the fact by experiment seems inexcusable.

"In my first attempt to discover the constituent parts and manufacture of isinglass, relying too much upon the authority of some chemical authors whose veracity I had experienced in many other instances, I found myself constantly disappointed. Glue, not isinglass, was the result of every process; and although, in the same view, a journey to Russia proved fruitless, yet a steady perseverance in the research proved not only successful as to this object, but in the pursuit to discover a resinous matter plentifully procurable in the British fisheries, which has been found by ample experience to answer similar purposes. It is now no longer a secret that the lakes and rivers in North America are stocked with immense quantities of fish, said to be the same species with those in Muscovy, and yielding the finest isinglass; the fisheries whereof, under due encouragement, would doubtless supply all Europe with this valuable article.

"No artificial heat is necessary to the production of isinglass, neither is the matter dissolved for this purpose; for, as the continuity of its fibres would be destroyed by solution, the mass would become brittle in drying, and snap short asunder, which is always the case with glue, but never with isinglass. The latter, indeed, may be resolved into glue with boiling water; but its fibrous recomposition would be found impracticable afterwards, and a fibrous texture is one of the most distinguishing characteristics of genuine isinglass.

"A due consideration that an imperfect solution of isinglass, called *fining* by the brewers, possessed a peculiar property of clarifying malt liquors, induced me to attempt its analysis in cold subacid menstruums. One ounce and a half of good isinglass, steeped a few days in a gallon of stale beer, was converted into good fining, of a remarkable thick consistence; the same quantity of glue, under similar treatment, yielded only a mucilaginous liquor, resembling diluted gum-water, which, instead of clarifying beer, increased both its tenacity and turbidness, and communicated other properties in no respect corresponding with those of genuine fining. On commixing three spoonfuls of the solution of isinglass with a gallon of malt liquor, in a tall cylindrical glass, a vast number of curdly masses became presently formed, by the reciprocal attraction of the particles of isinglass and the feculencies of the beer, which increasing in magnitude and specific gravity, arranged themselves accordingly, and fell in a combined state to the bottom, through the well-known laws of gravitation; for in this case there is no elective attraction, as some have imagined, which bears the least affinity with what frequently occurs in chemical decompositions.

"If what is commercially termed *long* or *short stapled isinglass* be steeped a few hours in fair cold water, the untwisted membranes will expand, and re-assume their original beautiful hue,[1] and, by a dexterous address, may be perfectly unfolded. By this simple operation we find that isinglass is nothing more than certain membranous parts of fishes, divested of their native mucosity, rolled and twisted into the forms above mentioned, and dried in open air.

"The sounds or air-bladders of fresh-water fish in general are preferred for this purpose, as being the most transparent, flexible, delicate substances. These constitute the finest sorts of isinglass; those called *book* and *ordinary staple* are made of the intestines, and probably of the peritoneum of the fish. The belluga yields the greatest quantity, as being the largest and most plentiful fish in the Muscovy rivers; but the sounds of all fresh-water fish yield, more or less, fine isinglass, particularly the smaller sorts, found in prodigious quantities in the Caspian Sea, and several hundred miles beyond Astracan, in the Wolga, Yaik, Don, and even as far as Siberia, where it is called *kle* or *kla* by the natives, which implies a glutinous matter; it is the basis of the Russian glue, which is preferred to all other kinds for its strength.

"The sounds, which yield the finer isinglass, consist of parallel fibres, and are easily rent longitudinally; but the ordinary sorts are found composed of double membranes, whose fibres cross each other obliquely, resembling the coats of a bladder; hence the former are more readily pervaded and divided with subacid liquors; but the latter, through a peculiar kind of interwoven texture, are with great difficulty torn asunder, and long resist the power of the same menstruum; yet, when duly resolved, are found to act with equal energy in clarifying liquors.

"Isinglass receives its different shapes in the following manner: The parts of which it is composed, particularly the sound, are taken from the fish while sweet and fresh, slit open, washed from their slimy *sordes*, divested of every thin membrane which envelopes the sound, and then exposed to stiffen a little in the air. In this state they are formed into rolls about the thickness of a finger, and in length according to the intended size of the staple. A thin membrane is generally selected for the centre of the roll, round which the rest are folded alternately; and about half an inch of each extremity of the roll is turned inwards. The due dimensions being thus obtained, the two ends of what is called *short staple* are pinned together with a small wooden peg; the middle of the roll is then pressed a little downwards, which gives it the resemblance of a heart-shape; and thus it is laid on boards, or hung up in the air to dry. The sounds which compose the long

[1] If the transparent isinglass be held in certain positions to the light, it frequently exhibits beautiful prismatic colours.

Ichthyocolla.

staple are longer than the former; but the operator lengthens this sort at pleasure, by interfolding the ends of one or more pieces of the sound with each other. The extremities are fastened with a peg, like the former; but the middle part of the roll is bent more considerably downwards, and, in order to preserve the shape of the three obtuse angles thus formed, a piece of round stick, about a quarter of an inch diameter, is fastened in each angle with small wooden pegs, in the same manner as the ends. In this state it is permitted to dry long enough to retain its form, when the pegs and sticks are taken out, and the drying completed; lastly, the pieces of isinglass are colligated in rows, by running pack-thread through the peg-holes, for convenience of package and exportation.

"The membranes of the *book* sort, being thick and refractory, will not admit a similar formation with the preceding; the pieces, therefore, after their sides are folded inwardly, are bent in the centre, in such manner that the opposite sides resemble the cover of a book, from whence its name; a peg being run across the middle, fastens the sides together, and thus it is dried like the former. This sort is interleaved, and the pegs run across the ends, the better to prevent its unfolding.

"That called *cake-isinglass* is formed of the bits and fragments of the staple sorts, put into a flat metalline pan, with a very little water, and heated just enough to make the parts cohere like a pancake when it is dried; but frequently it is overheated, and such pieces, as before observed, are useless in the business of fining. Experience has taught the consumers to reject them.

"Isinglass is best made in the summer, as frost gives it a disagreeable colour, deprives it of weight, and impairs its gelatinous principles; its fashionable forms are unnecessary, and frequently injurious to its native qualities. It is common to find oily putrid matter, and *exuviæ* of insects, between the implicated membranes, which, through the inattention of the cellarman, often contaminate wines and malt liquors in the act of clarification. These peculiar shapes might probably be introduced originally with a view to conceal and disguise the real substance of isinglass and preserve the monopoly; but, as the mask is now taken off, it cannot be doubted to answer every purpose more effectually in its native state, without any subsequent manufacture whatever, especially to the principal consumers, who hence will be enabled to procure sufficient supply from the British colonies. Until this laudable end can be fully accomplished, and as a species of isinglass more easily produceable from the marine fisheries may probably be more immediately encouraged, it may be manufactured as follows:

"The sounds of cod and ling bear great analogy with those of the *accipenser* genus of Linnæus and Artedi, and are in general so well known as to require no particular description. The Newfoundland and Iceland fishermen split open the fish as soon as taken, and throw the backbones with the sounds annexed in a heap; but previous to incipient putrefaction, the sounds are cut out, washed from their slimes, and salted for use. In cutting out the sounds, the intercostal parts are left behind, which are much the best; the Iceland fishermen are so sensible of this, that they beat the bone upon a block with a thick stick, till the pockets, as they term them, come out easily, and thus preserve the sound entire. If the sounds have been cured with salt. that must be dissolved by steeping them in water before they are prepared for isinglass; the fresh sound must then be laid upon a block of wood, whose surface is a little elliptical, to the end of which a small hair-brush is nailed, and with a saw-knife the membranes on each side of the sound must be scraped off. The knife is rubbed upon the brush occasionally, to clear its teeth; the pockets are cut open with scissars, and perfectly cleansed of the mucous matter with a coarse cloth; the sounds are afterwards washed a few minutes in lime-water, in order to absorb their oily principle, and lastly in clear water. They are then laid upon nets to dry in the air; but if intended to resemble the foreign isinglass, the sounds of cod will only admit of that called *book*, but those of ling both shapes. The thicker the sounds are, the better the isinglass, colour excepted; but this is immaterial to the brewer, who is its chief consumer.

"This isinglass resolves into fining, like the other sorts, in subacid liquors, as stale beer, cider, old hock, and the like, and in equal quantities produces similar effects upon turbid liquors, except that it falls speedier and closer to the bottom of the vessel, as may be demonstrated in tall cylindrical glasses; but foreign isinglass retains the consistency of fining preferably in warm weather, owing to the greater tenacity of its native mucilage. "Vegetable acids are in every respect best adapted to fining; the mineral acids are too corrosive, and even insalubrious, in common beverage.

"It is remarkable, that during the conversion of isinglass into fining, the acidity of the menstruum seems greatly diminished, at least to taste, not on account of any alkaline property in the isinglass, probably, but by its enveloping the acid particles. It is likewise reduced into jelly with alkaline liquors, which indeed are solvents of all animal matters; even cold lime-water dissolves it into a pulpous *magma*. Notwithstanding this is inadmissible as fining, on account of the menstruum, it produces admirable effects in other respects; for, on commixture with compositions of plaster, lime, &c. for ornamenting walls exposed to vicissitudes of weather, it adds firmness and permanency to the cement; and if common brick-mortar be worked up with this jelly, it soon becomes almost as hard as the brick itself; but for this purpose it is more commodiously prepared by dissolving it in cold water acidulated with vitriolic acid, in which case the acid quits the jelly, and forms with the lime a *selenitic* mass, while, at the same time, the jelly being deprived in some measure of its moisture, through the formation of an indissoluble concrete amongst its parts, soon dries, and hardens into a firm body; whence its superior strength and durability are easily comprehended.

"It has long been a prevalent opinion, that sturgeon, on account of its cartilaginous nature, would yield great quantities of isinglass; but, on examination, no part of this fish, except the inner coat of the sound, promised the least success. This being full of *rugæ*, adheres so firmly to the external membrane, which is useless, that the labour of separating them supersedes the advantage. The intestines, however, which in the larger fish extend several yards in length, being cleansed from their mucus and dried, were found surprisingly strong and elastic, resembling cords made with the intestines of other animals, commonly called *catgut*, and, from some trials, promised superior advantages when applied to mechanic operations."

ICHTHYOLOGY.[1]

INTRODUCTORY CHAPTER.

Introduction.

SECT. I.—DEFINITION AND GENERAL OBSERVATIONS. THE PRINCIPAL EPOCHS IN THE SCIENCE OF ICHTHYOLOGY.

FISHES may be technically defined as *vertebrated animals with red blood, breathing through the medium of water by means of branchiæ or gills.* This definition, as Baron Cuvier has remarked, is the result of observation; it is a product of analysis, or what is termed in physics an empyrical formula; but its accuracy is demonstrable by the inverse method, for, when once duly perceived, we may in a great measure deduce from it a knowledge of the entire nature of the beings to which it is applied. Being vertebrated, they must be possessed of an internal skeleton; of a brain and spinal marrow, enclosed in a vertebral column; of muscles exterior to the bones; of four extremities only; and of the organs of the first four senses, situate in the cavities of the head; with other relations not necessary to be here named.

The greater portion of the surface of the earth is covered by the waters of the translucent sea; and wherever continents and the larger islands protrude their rocky bulk, we find them coursed by flowing rivers, or intersected by lakes and marshes. These present in their aggregate an enormous mass of waters, and afford protection and nourishment to myriads of living creatures, probably superior in number, and in no way inferior in beauty, to those which inhabit the earth. On land, the matter susceptible of life is mainly employed in the construction and continuance of vegetable species; from these herbivorous animals draw their nourishment; and this being animalized by assimilation, becomes an appropriate food for the carnivorous kinds, which scarcely amount to more than one half of the terrestrial creatures of all classes. But in the liquid element, and more especially among the saline waters of the ocean, where the vegetable kingdom is so much more restricted, almost all organized substances are pervaded by animal life, and each lives at the expense of some smaller or feebler foe. There we meet not only with the greatest and most wonderful variety of forms, but also with the extremes in respect to size,—from the myriads of microscopic monads, which, but for artificial means, must have remained for ever invisible and unknown, to the ponderous whale, which surpasses by twenty times the bulk of the largest elephant. There, too, we may discover the majority of those magnificent combinations of organic structure, on the relations of which naturalists have established the distinction of classes, or great primary groups,—in other words, the sea may be said to contain representatives of each; for, even among birds, those aerial creatures which usually inhabit so light an element, we find species so constructed as to dwell almost for ever on its waves. The mammiferous class is still more fully represented in the numerous tribes of seals, morses, manaties, and whales, all of which require a moist abode, and some of which immediately perish when deprived of it. Most reptiles are aquatic, many insects are so, more particularly in their larva state; and almost all the Mollusca, the Annelides, the Crustacea, and Zoophytes,—four great classes, which on terra firma are few and far between,—exist in countless numbers in the waters of the ocean. Hence that ancient dictum recorded by Pliny, " Quicquid nascatur in parte naturæ ulla, et in mari esse; præterque multa quæ nusquam alibi."

But amongst all the teeming wonders which vivify the vast expanse and liquid depth of waters, none so predominate, or are so truly characteristic, as the subjects of our present treatise; nor are any more worthy of our devoted consideration, whether we regard the beauty or eccentricity of their forms, the metallic splendour of their colours, or the innumerable benefits which, through the foresight of Providence, they confer upon the human race. We therefore deem it incumbent upon us to exhibit an ample view of the present condition of Systematic Ichthyology; but before doing so, we shall endeavour to add to the interest of the subject by a few general observations.

We may state, in the first place, that we here intentionally refrain from any bibliographical inquiry, or historical exposition of the progress of Ichthyology. If such were complete, or even ample, it would occupy too much of that space which we deem more usefully devoted to the actual condition of our subject-matter. We more willingly set that department aside, when we consider how perfectly it has been presented by Baron Cuvier.[2] We shall, however, briefly allude to what may be regarded as the principal epocha in the progress of Ichthyological Science. During many remote ages it consisted, in common with all the kindred branches of human knowledge, of nothing more than a few partial and disjointed observations. Aristotle, about 350 years before the Christian era, made some progress towards connecting these together as a body of doctrine; but still it was a feeble body, reposing upon truths (perceived indeed with surprising skill when we consider the scanty data) as yet obscurely known and vaguely expressed, owing to the entire absence of all proper standards for the distinction of species. For more than eighteen hundred years ensuing, those who wrote on natural history can scarcely be regarded in any other light than as either copiers or commentators of Aristotle; but about the middle of the sixteenth century, Belon, Rondelet, and Salviani, the true founders of modern Ichthyology, made their appearance (we mean as authors), by a singular coincidence, almost precisely at the same time,—the first in 1553, the second from 1554 to 1555, and the third from 1554 to 1558. Differing from their compiling predecessors, they

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[1] From ἰχθυς, *a fish*, and λογος, *a discourse*.

[2] See the *Tableau Historique des Progrès de l'Ichtyologie, depuis son origine jusqu'à nos jours*, in the first volume of his great though unfortunately uncompleted work, the *Histoire Naturelle des Poissons.* We deem ourselves fortunate beyond our predecessors in encyclopædic labour, in having as a guide in so difficult a subject as that on which the reader is about to enter, the first nine volumes of Baron Cuvier's signal publication. We should act unwisely were we to present a crude compendium of the works of foreign and British writers, such as has hitherto sufficed for publications similar to that in which we are now engaged. We prefer adhering throughout to Cuvier's system of arrangement, as one which, without doubt, is entitled to supersede all others hitherto proposed. We shall also avail ourselves, wherever our doing so seems likely to instruct the reader, of whatever general or miscellaneous information is scattered through his work, presenting it in a form and sequence the most advantageous to those unacquainted with the voluminous original; and adding, especially in relation to our native species, whatever we find of interest in recent authors, among whom, as elucidators of " British Fishes," Messrs Couch and Yarrell stand pre-eminent. We beg to make this general acknowledgment of the infinite advantage we have derived from Baron Cuvier's labours, in the formation of the present treatise, in reference both to our introductory and systematic portions.

Introduction.

saw and examined for themselves, and made drawings from nature, if not with the elegant accuracy of modern days, at least with a recognisable exactness. Yet, true to the genius of their time, they continued to attach much more importance to the ascertainment of the names which the species bore in the classical pages of antiquity, than to the composition of their history, as it were afresh, by the light of nature and their own knowledge. Nevertheless they rectified as well as extended the observations of Aristotle, and laid a positive base or new foundation of the subject, by figures and descriptions of a certain number of well-determined species. About the close of the seventeenth century, Willughby, and his illustrious friend John Ray, gave for the first time a history of fishes, in which the species were not only clearly described from nature, but distributed in accordance with characters drawn solely from their structure, and in which we are no longer unnecessarily burdened with inapplicable passages from either Greek or Roman writers. Finally, about the middle of the eighteenth century, Artedi and Linnæus completed what the others had commenced, by establishing well-defined generic groups, consisting of ascertained species precisely characterised. From that period it may be said that no radical defect existed, nor any obstacle in the way of a gradual perfecting of the system, which could not be overcome by zeal, accuracy, and perseverance. Nevertheless it is to the genius of Baron Cuvier that we owe the gigantic stride which has been made in our own more immediate days. Prior to 1815, the methods of almost all the modern systematic writers were little else than modifications, variously disguised, of the Linnæan system,—that is, with alterations, generally for the worse, of the nomenclature of the illustrious Swede. They darkened knowledge by a multiplicity of vain words;—and when any principle of classification was brought forward,—if new, then it was untrue to nature,—if true to that beautiful abstraction, then it was already familiar as household words. But forty years assiduously devoted to Ichthyology,—that is, to a deep study of all preceding authors, to a constant ascertainment of whatever could be gathered of the habits of fishes, and to the formation of an unrivalled museum of comparative anatomy, where both their outward and internal forms were perfectly displayed,—convinced the great French naturalist that many heterogeneous groups still formed portions of our ichthyological system, and that a salutary reformation might consequently be effected in numerous minor details.

It was obvious, from an attentive consideration of the subject, that the differences of both external and interior organs, by which fishes might be distinctly characterised, were not less numerous than decided; and that in truth there were few classes of created beings among which it was more easy to recognise the existence of natural groups. But with a view to dispose of the genera and families in a becoming order, it was necessary to seize upon a small number of important characters, from which might result certain great divisions, not likely to break up natural relations, and yet sufficiently precise and perceptible to leave no doubt as to the place of each species. This was a principal desideratum, and one which the industry and perseverance, not less than the genius and high attainments, of Cuvier, have gone so far to satisfy.

The numerous characters held in common by the chondropterygian or cartilaginous fishes were too remarkable to have escaped detection by those who loved and sought for the light of system. Thus all Ichthyologists have agreed in the formation for these fishes of a separate order; but the Baron has observed, that almost all have likewise injured the justness of their ordinal division, by a combination of certain species which resembled the true cartilaginous kinds merely in the softness of their skeleton. Thus the genera *Lophius* and *Cyclopterus*, except in that softness, do not differ in any respect from the ordinary osseous fishes, and therefore ought not to be withdrawn from them. But there are others which, in addition to the softness of their bones, present peculiar characters in their tegumentary system, in their teeth, and especially in the disposition of the skeleton of the head, which render their immediate union with either of the great groups of osseous or cartilaginous fishes a matter of greater doubt and difficulty. Such, for example, are the genera *Tetrodon*, *Diodon*, *Ostracion*, and *Balistes*. The *Syngnathi*, or pipe-fish, likewise present, in their peculiar branchiæ, distinctive characters of great importance. The remarkable external aspect of these different genera had long induced the majority of naturalists to separate them from the others; but it so happened also that the same majority were by no means fortunate in discovering the true characters of separation. Thus Artedi not only re-united them to the *Lophii* and lump-fish, in the order of branchiostegous fishes, but he established that entire order on a false supposition—to wit, that they possessed no rays in their branchial membrane ("*branchiis osseis, ossibus destitutis,*"—"*branchiostegi in branchiis nulla ossicula gerunt,*"[1])—while the fact is, that they all possess those rays, and that even Artedi himself has inadvertently described both their nature and their number (*membrana branchiostega ossicula sex gracilia continet*) in his notice of the lump-fish (*Cyclopterus*) in question.[2]

Linnæus,[3] after placing the chondropterygian fishes among the reptiles, and adding thereto the genus *Lophius*; after referring the *Mormyri* and *Syngnathi* to the branchiostegous fishes of Artedi, and assigning to them the character of wanting not only the rays of the branchiæ, but the opercula (the contrary in several species being obvious to the most simple observation); afterwards combined[4] the Chondropterygii and Branchiostegi into a single order of *reptiles* (*Amphibia Nantes*), on the supposed but quite erroneous basis of their being possessed at once of lungs and gills. Gmelin re-established the two orders of Artedi, but still attributing to the Branchiostegi the absence of rays. Gouan characterised them merely by the incompleteness of their branchiæ,—a vague expression, and indeed contestable in almost all the genera. Pennant combined them with the Chondropterygii, under the common name of *Cartilaginous*, a term adopted by M. Lacépède; but which Cuvier has shown, in relation to the actual contents of the group, to be improper. The great French anatomist has observed that the appellation is by no means applicable, either in a positive or a negative sense. It cannot in any way be maintained that the skeleton of the *Balistes* is cartilaginous; and among the number of species which Pennant and his followers leave among the osseous fishes, there are several, for example, the *Leptocephali*, in which we can scarcely perceive the vestige of a skeleton.[5]

Baron Cuvier's great object thus became, to disentangle, as it were, those anomalous groups, or at least to separate all such as seemed to differ sufficiently from the type of ordinary fishes to authorize such separation. His next object was the discovery of precise characters, capable of being clearly expressed in words. This examination soon convinced him that such genera as *Lophius*, *Cyclopterus*, *Centriscus*, *Mormyrus*, and *Macrorhynchus*, had been erroneously withdrawn from the great group of ordinary

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[1] *Genera Piscium*, p. 85.
[2] *Ibid.* p. 62.
[3] *Systema Naturæ*, 10th ed.
[4] *Systema Naturæ*, 12th ed.
[5] *Hist. Nat. des Poissons*, t. i. p. 555.

Introduction.

fishes, from which in fact they essentially differed in nothing. But he satisfied himself that the singular genus *Syngnathus*, of which the form and economy are so remarkable, were distinctively characterised by their branchiæ, in the form of tufts (hence the title of *lophobranchial* fishes), concealed beneath an opercle which permits the water to escape only by a small opening towards the nape of the neck; and that the genera *Diodon*, *Tetrodon*, *Ostracion*, and *Balistes*, independently of the singularity of their general form, and the incompleteness of their skeleton, have the jaws, and in general all the bones of the head, somewhat differently arranged from the corresponding parts in the generality of fishes, the upper jaw and the palatine bones being articulated with each other, and with the vomer, by immoveable sutures—a structure which leaves them much less freedom in the opening of their mouths, and is also the cause (in connection with the tightness of the tegumentary envelope which fastens down the branchial apparatus) of so many naturalists having failed to perceive that the genera in question were furnished with rays and opercula like other species.

But these groups once separated, there remained nine tenths of the whole class of fishes, among which the first great distinctive division which presents itself is, into such as have soft fins, or of which the rays are branched and articulated, and into such as have spiny fins, of which a portion of the rays consist of pointed bones without branches or articulation,—two primary divisions, corresponding to the great groups named respectively Malacopterygii and Acanthopterygii by Artedi. Even this principle of classification is not universally prevalent; for, in its practical application, we are obliged to keep out of view the first rays of the dorsal and pectoral fins in certain species of the genera *Cyprinus* and *Silurus*, in which these rays exhibit strong and solid spines, although we still class them with the Malacopterygii, or soft-finned division.[1] In like manner, there are, among the other great division, corresponding exceptions to the acanthopterygian character, as in the blennies and certain Labridæ, of which the spines are so small, so feeble, or so few in number, as almost to escape detection. However, if the principle referred to is not quite precise in relation to these slight anomalies, it is on the whole well founded, and certainly does not force us to separate numerous species which nature has approximated.

The same cannot be asserted of those distinctions which naturalists have sought to establish on other principles, nor of those on which so many of the secondary divisions have been founded. Thus the general form of the body, and the absence of the ventral fins, the characters assumed by Ray, anterior to those deduced from the spines, force a heterogeneous grouping of the eels, the gobies, the Syngnathi, the Xiphias, and the moon-fish. Linnæus was the first (in the tenth edition of the *Systema Naturæ*), while neglecting the distinction of the spiny rays, to imagine the division of ordinary fishes into *apodal*, *jugular*, *thoracic*, and *abdominal*, according to the absence or position of the ventral fins; and in so doing obliged himself to place the genera *Xiphias*, *Trichiurus*, and *Stromateus* with the eels and *Gymnoti*, the *Gadi* between the weevers and the blennies, *Pleuronectes* between *Zeus* and *Chætodon*, and the *Amphacanthi* as intermediate with *Silurus* and *Loricaria*. Various modifications have since been proposed of the Linnæan arrangement, but our present limits will not admit of our entering upon these as exhibited in the various works of Gouan, Lacépède, Dumeril, Risso, Rafinesque, Goldfuss, Oken, and others who have laboured to amend the modern system.[2]

SECT. II.—THE EXTERNAL FORM AND CHARACTER OF FISHES.[3]

The form and structure of fishes are as admirably adapted for rapid movement through the water, as are those of birds for that aerial motion called flight. Suspended in a liquid element of almost equal specific gravity with themselves. external organs resembling those of birds in size would have been disproportioned and unnecessary; but the air-bladder (the functions of which, by no means entirely understood, have never been satisfactorily explained in all their bearings) is known to possess the power of contraction and dilatation, the exercise of which is followed by a corresponding descent or ascent of the animal's body. Thus a small, central, and inconspicuous organ effects, in the easiest and most simple manner, the same object which even the soaring eagle or giant condor can only attain by great exertion of the wings, and after laborious and frequently repeated gyrations. We shall ere long, however, have occasion to observe, that the air-bladder, although essential to the economy of such species as possess it, is by no means indispensable to the class of fishes, as in many tribes it is entirely wanting.

Fishes being without a neck, and the part called the tail for the most part equalling at its origin the portion of the trunk from which it springs, the prevailing shape is somewhat uniform, diminishing gradually towards either end. Doubtless, however, a vast variety of form is exhibited in a class which is now calculated to contain from six to eight thousand collected species. Of these forms a sufficiently accurate idea may be acquired by inspecting the numerous plates which accompany the present treatise, and we shall therefore not attempt any further verbal illustration of the subject, although we shall add a few notices regarding the general aspect and character of the principal external parts.

The mouth of fishes either opens from beneath, as in the rays, or at the extremity of the muzzle, as in the majority of the class, or from the upper surface, as in *Uranoscopus*. It also varies greatly in its relative dimensions, from the minute perforation of *Centriscus*, to the vast expansion of the angler fish.

Exteriorly only two of the organs of the senses are visible, the orifices of the nostrils and the eyes. The former may be simple, as in the rays and sharks, or double, as in the generality of osseous fishes; and they differ in their position in relation to the jaws, the eyes, or the extremity of the muzzle. The eyes vary extremely in respect to size in the different species, and even sometimes disappear entirely beneath the skin; and they also differ greatly in their position, being usually placed laterally, one on each side of the head, although in *Uranoscopus* (as the name implies) they look upwards, and in most of the flat fishes they both occupy the same side.

In regard to those important organs, the branchiæ or gills, a single family alone, the chondropterygian fishes,

[1] These spines, however, as Cuvier remarks, are formed, in the two genera above named, by the agglutination of a multitude of smaller parts, of which the articulations, though not obvious, are perceptible.

[2] For critical notices of their works, see the 1st volume of the *Hist. Nat. des Poissons.*

[3] We may here premise, that in the ensuing sections several interesting and important particulars in the structure and physiology of fishes are very slightly, or even not at all, touched upon, in consequence of their having been already detailed in the article Comparative Anatomy of this work. (See vol. iii. p. 1, &c.) We deemed it more advisable that the reader should be made to incur the slight inconvenience of referring occasionally to a separate treatise, than that the present publication should be burdened by a repetition of the same subject.

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are characterised by having their exterior margin fixed to the skin, with as many openings for the issue of the water as there are intervals between the branchiæ themselves; but all other fishes have the external margin of the branchiæ free, and the water which enters the mouth escapes by the opening of the gill-covers.

A certain number of the fins are vertical, and serve the fish somewhat in the same way as a vessel is served by her helm and keel. Of these, some, called *dorsal*, are attached to the back, others, beneath the tail, are named *anal*, while a fine expansion, which usually terminates the body, is known as the *caudal* fin. All these are *vertical* fins, and vary in different tribes, either in number, or dimensions, or the nature of the rays by which they are supported, and which are sometimes spiny, sometimes branched and composed of numerous articulations. The other fins are disposed in pairs, and represent the four external members of the higher classes, such as quadrupeds and birds. Those which correspond to the fore-legs of quadrupeds and the wings of birds are named the *pectoral* fins, and are always attached behind the gills; those again which are regarded as the analogues of the hinder extremities of the other classes are named the *ventral* fins, and have a considerable range of position in different species, from as far forward as beneath the throat, to the origin of the tail. Like the vertical fins, they also vary in size, and in the number and structure of their rays; and one or even both pairs are occasionally wanting, as in eels, which have no ventral fins, and Murenæ, which have neither ventral nor pectoral fins. Indeed the *Apterichti* have no fins at all.

Those fishes are named MALACOPTERYGIAN, of which all the rays of the fins are articulated, and of a softer structure; while such as are characterised by having at least a portion of their rays hard, simple, and in the form of spines, are included under the general title of ACANTHOPTERYGIAN fishes.[1] These great divisions apply solely to the osseous species. We have already mentioned that the cartilaginous kinds are distinguished by the name of CHONDROPTERYGIAN, while two lesser groups, in some respects intermediate between these and the preceding, fall under the orders LOPHOBRANCHII and PLECTOGNATHI of Baron Cuvier.

The differences hitherto alluded to are connected with intimate structure—with the skeleton or bony frame-work of the fish. There are of course others of a slighter or more superficial character. The jaws may be armed with teeth of all sorts, and these weapons sometimes occupy all parts of the mouth, and are found occasionally even in the throat. The lips are frequently furnished with a kind of fleshy beard or barbles, which differ greatly in number, size, and substance. Some have long fleshy isolated filaments hanging to the body, as in *Scorpæna;* and occasionally one or more of the rays is to a certain extent detachable from the fin, and susceptible of independent movement.

The nature of the surface or external tegument of fishes also varies greatly. Some may be called naked, while others are scaly, spinous, or plated, in whole or in part. If to these considerations we add the infinitely varied character of colour in all its admirable distributions, and the differences in size and weight observable in fishes, we shall be able to form a general idea of the external aspect of this great and important class.

SECT. III.—THE OSTEOLOGY OF FISHES.

In regard to the texture of the bones of fishes, their skeletons are either *bony*, *fibro-cartilaginous*, or *truly cartilaginous.* Those distinguished by the last-named character are the chondropterygian groups, such as the sturgeons, sharks, and rays, all of which exhibit throughout the whole of their frame-work, in their branchiæ (the external border of which is fixed to the skin, and through which the water is allowed to escape only by narrow openings), and in other important parts of their organization, distinctive characters, which obviously separate them from all other fishes. They are in fact destitute of true bones, their harder parts consisting only of a homogeneous and semitransparent cartilage, which is merely covered on the surface in certain genera by a layer of small, opake, calcareous granules, closely set together. In the lampreys even this envelope is wanting, while among the *Ammocœtes* the skeleton continues in an actually membranous condition. The sturgeons and Chimeræ partake in some measure of the lamprey character in relation to the softness of their spines, but the first-named genus is possessed of many true bones of the head and shoulder.

Other fishes differ in their osteological character chiefly in the hardness of their skeleton, and it is without reason that the fibro-cartilaginous kinds have been associated by some authors with the Chondropterygii. The calcareous matter, that is, the phosphate of lime, is deposited in layers and fibres in the cartilage which forms the basis of their bones, precisely in the same manner as among the hard-boned species, but less abundantly; and the texture of the bone never becomes so hard and homogeneous as among the osseous kinds. Thus in *Tetrodon Mola* we perceive, as it were, only scattered fibres amid the membranes, and in *Lophius piscatorius* they are nearly as soft. The other Tetrodons and Diodons, the Balistes and the Ostracions, have denser bones; and in some species these parts can scarcely be distinguished from those of the osseous fishes. It is certain also that the bony frame-work of the fibro-cartilaginous kinds is constructed on the same plan as that of the truly osseous species, and not in accordance with those of the Chondropterygii; and it is in opposition to the known truth of nature that both Artedi and Linnæus have denied them the possession of opercula and branchiostegous rays. The *Balistes* have even ribs,—their only osteological difference consisting in the granulation of their jaws; while the *Syngnathi* have regular bony jaws, although they want the ribs and branchiostegous rays.

The majority of osseous fishes have bones fully harder than those of other animals, and it is quite a gratuitous assumption to suppose that the observed longevity of certain species arises from the softer consistence of those parts. Certain fish bones, in fact, exhibit neither pores nor fibres, and appear almost vitreous to the eye. But neither the osseous nor the cartilaginous kinds have either epiphyses to the bones, or medullary canal within them; but there are some, such as the trouts, in which the tissue of the bones is more or less penetrated by an oily juice; while in others, such as the Dory, the internal portion continues cartilaginous, while the surface is completely ossified. Finally, in certain species, while the general skeleton is very hard, particular portions of it are cartilaginous. Such are the bones which constitute the head of the pike.

When viewed in relation to their general structure, the bones of fishes, like those of other vertebrated animals, are composed of an organic base penetrated by earthy matter. The latter consists of phosphate of lime and of magnesia, with oxide of iron, supposed to be united to phosphoric acid. There is also a certain portion

[1] It may be here noted, however, that certain malacopterygian kinds, such as carps and siluri, have the articulations of some of the rays soldered together, in such a manner as to appear simply spinous.

of subcarbonate of lime. The animal matter is of two kinds:—the one, of an azotised nature, forms the base of the cartilage; the other is fatty, in the form of a pervading oil. The cartilage of fish bones differs from that of mammiferæ and birds, in as far as it yields no gelatine when subjected to the process of boiling. The oil is composed chiefly of oleine, impregnated with an odorous principle and a yellow colouring matter. The oil itself is easily convertible into soap, and then produces oleic acid, glycerine, and a minute portion of margaric acid.

The skeleton of osseous fishes consists of the head; of the respiratory apparatus, having always a large bony development; of the trunk, including body and tail; and of members, that is, the pectoral and ventral fins. The vertical fins, viz. those of the back, anus, and tail, may likewise be viewed as belonging to the trunk.

The head, possessing many more moveable parts than that of the Mammalia, is subdivisible into a great many regions, such as the cranium, the maxillæ, the bones beneath the cranium and behind the jaws, and which aid in their movement and suspension; the bones of the opercles, which open and shut the overtures of the branchiæ; the bones, almost exterior, which surround the nostrils, the eye, and the temples, or which cover a portion of the cheek.

In the majority of fishes the inter-maxillary bone forms the edge of the upper jaw, and has behind it the maxillary, commonly called the mystax, or labial bone. A palatine arch, composed of the palatine, of the two pterygoid processes, of the jugal, tympanic, and squamous bones, constitutes, as among birds and snakes, a kind of interior jaw, and provides posteriorly an articulation to the lower jaw, which has usually two bones on each side. In the Chondropterygii, however, these various pieces are greatly reduced in number.

Besides the apparatus of the branchial arches, the hyoid bone carries on each side certain rays which support the branchial membrane; a kind of lid or clapper, composed of three bony pieces, the opercle, the sub-opercle, and the inter-opercle, unites with that membrane to close the great opening of the gills; it articulates with the *os tympani*, and plays on the piece called the pre-opercle. But, like the parts before mentioned, this apparatus is likewise wanting in many of the Chondropterygii.

The trunk is composed of the vertebræ of the back and tail (for we can scarcely say that there is any neck, and the sacrum is wanting); of ribs; of the interspinal bones, which give support to the dorsal and anal fins; and of the rays of those fins, and of the caudal. These rays, whether branched and articulated, or simply spinous, may be always divided lengthways into halves.

The vertebræ of fishes are characterised by the conical hollow on each of their faces. Double hollow cones are thus formed in the interval between two vertebræ, filled by a soft membranous and gelatinous substance, which passes from one void to another by means of an opening through each vertebra, and forms as it were a gelatinous chaplet through the whole. They have, as in other animals, an annular portion in their superior part, for the passage of the spinal marrow.

Fish rarely possess a sternum properly so called, and when it does exist, it is formed of almost external pieces, which unite the inferior extremities of the ribs.

The anterior members, commonly called the pectoral fins, consist of the shoulder, an osseous semicircle composed of several bones suspended above from the cranium or the spine, and joined beneath to the corresponding portion of the other side. We can here also distinguish certain bones analogous to the two pieces of the omoplate of reptiles, to the humerus, and to the bones of the fore-arm; and further back there is usually a small projection, composed of two pieces, which have been supposed to represent the coracoid bone, and even the clavicle. What is more assured is, that the two bones which Cuvier compares to the cubitus and radius, bear on their margin a range of little bones, which seem to represent those of the carpus, and which themselves support the rays of the pectoral fin, excepting the first of the latter, which articulates directly with the radial bone.

The posterior members, much more variable in their position than the corresponding limbs of the Mammalia, and of which the external and moveable portions are named the ventral fins, project sometimes in advance of, sometimes beneath, and sometimes behind, the anterior or pectoral members. They are composed of four bones, of which the largest, which are likewise the most constant, being always placed in advance of the anus and of the generative system, may be regarded as a sort of pubis, and bear upon a portion of their posterior margin the rays of the fin, without any smaller intermediate bones which can be compared either to the femur, the tibia, the peroneum, or tarsal bones. The rays of both the pectoral and ventral fins are likewise divisible lengthwise into halves, like those of the vertical fins before mentioned. These rays, with the exception of the external ventral one of the *Acanthopterygii* (which is spinous), are almost always articulated.

The skeleton of the *Chondropterygii*, such as sharks and skates, is composed of pieces consisting of no fibrous tissue characteristic of bone. The interior continues in a cartilaginous state, and the surface alone becomes indurated by the accumulation of small calcareous granules, which produce externally a *stippled* aspect. The form of the cranium is similar to that of other fishes, but nevertheless consists of only one enclosure, without sutures. The face is very simple, with only two bones in the palato-temporal arch;—the first descending from the cranium, at the articulation of the jaws,—the other representing the upper jaw, and bearing the teeth. The maxillary and inter-maxillary bones are merely rudimentary. The under jaw has also but one bone (the articular) on each side, bearing the teeth; of the others only a single vestige is discoverable, concealed beneath the skin of the lip. The opercular apparatus is wanting, but the hyoidean and branchial structure is very conformable with the same parts in osseous fishes. Sharks have, moreover, opposite to the external attachment of each branchia, a slender bone, which may be regarded as the genuine vestige of a rib. The branchial system is situate further back than in osseous fishes, and hence the humeral girdle is also more posterior. The spinal ribs, if they exist, are usually very small, except in the sturgeons. In that genus, indeed, the branchial system is in some respects intermediate between the cartilaginous and osseous fishes. Several bones of the head and shoulder are as hard as stone, yet the spine is almost as soft as that of lampreys.[1]

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[1] For the sake of a more explicit comprehension of the principal portions of the osteological system of fishes, we have figured (from Cuvier) the skeleton of the perch. We shall here subjoin the names of the bones, in reference to the engraved numerals. See Plate CCXCVII. figs. 1, 2, 4, 5.

Cranium: Principal frontal, 1; anterior frontals, 2; ethmoidal, 3; posterior frontal, 4; basilary, 5; sphenoid, 6; parietals, 7; inter-parietal, 8; external occipital, 9; occipital lateral, 10; great ala, or temporal ala, 11; mastoidean, 12; rupes, 13; orbitary ala, 14; anterior sphenoid, 15; vomer, 16. *Upper jaw:* Inter-maxillary, 17; maxillary, 18. *Nasal, sub-orbitary, and supra-temporal bones:* First sub-orbitary, 19; chain of bones attached to the last named, and ending at the posterior frontal (these are conspicuous in Trigla and Scorpæna), likewise numbered 19; nasal, 20; supra-temporals, 21. *Palatine arch*, or *palatino-pterygoidean* and

SECT. IV.—THE MUSCLES AND MUSCULAR MOTIONS OF FISHES.

The spinal column, composed of numerous articulations united by cartilages which permit of certain movements, curves with great facility from side to side; but the vertical motion is much more restricted, chiefly in consequence of the projection of the upper and under spiny processes of the vertebræ.

The great organ of movement in all fishes is the tail. The muscles by which it is brought into play extend in lengthened masses on either side of the vertebral column. The body being supported chiefly by the swimming bladder (which, however, is absent in several species), is pro-

temporal system: Palatine, 22; temporal, 23; transverse bone, 24; internal apterygoidean, 25; jugal, 26; tympanal, 27. *Opercular bones:* Operculum, 28; styloid, 29; pre-operculum, 30; sympletic, 31; sub-operculum, 32; inter-operculum, 33; this last-named bone furnishes an attachment to the branch of the hyoid bone at the point where it is itself joined to the styloid, which suspends it on the temporal bone, and hence the opercular shutters can neither open nor close without a corresponding movement of the hyoidean branches. *Lower jaw:* Dental, 34; articular, 35; these are the usual divisions, but there is often a third bone, the angular, 36, and sometimes a fourth, on the internal face of the articular, corresponding to the opercular of reptiles, 37. Thus the head of fishes usually consists of about sixty bones—the amount being sensibly greater in such species as have the upper maxillary subject to division.

Hyoid bone and branchiostegous rays. The three opercular pieces above mentioned do not of themselves effect the closure of those great clefts observable on each side of a fish, between the head and shoulder, and within which are the respiratory organ sor branchiæ. This closure is completed by the *branchiostegous membrane,* which adheres to the hyoid bone. (See Plate CCXCVII. figs. 2, 4, and 5.) This bone is placed as in other vertebrated classes, but is always suspended to the temporal bones. It is composed of two branches, each consisting of five pieces, viz. the styloid, 29, by which it is suspended to the temporal; two large lateral pieces, 37 and 38, placed one behind the other, and forming the principal portion of the branch (the posterior, 38, being that which attaches to the inter-operculum); lastly, two small pieces, 39 and 40, placed one above the other at the anterior extremity of the branch, and serving to unite it with the corresponding portion of the other side. Anterior to this junction is the lingual bone, 41, and behind it, in the angle formed by the meeting of the two branches, and beneath the branchiæ, is a single piece, usually vertical, 42 (fig. 5), which represents the tail of the hyoid bone, so well known in birds and lizards. It is this piece which, uniting with the symphyses of the humerals, forms what is called the *isthmus,* which separates the two branchial openings from below. Thus in its totality the hyoid bone of fishes is composed of twelve bones.

The *rays,* 43, which support the branchiostegous membrane, adhere by moveable articulation, or by simple ligaments, to the inferior margin of the principal portions already mentioned (37, 38) of the hyoid bone. They vary in form and number, some species having three, others thirty. The perch, which forms the subject of our illustration, has seven branchial rays; and that number is the most common among the acanthopterygian fishes.

Bones which support the branchiæ. As fishes cannot respire except by making the water which they have taken into the mouth flow out by the openings behind the lateral part of the head, it thus passes between the branchiæ, those well-known comb-like organs, usually four in number on each side, composed of a great quantity of thin, narrow, forked laminæ, of a membranous or cartilaginous nature, and placed in files. These four pair of branchiæ are supported by four pair of arches, adhering by their inferior extremities to the two sides of a chain of small intermediate bones, which is itself attached to the angle formed by the anterior portions of the hyoid bone, and above the *tail* of the latter. These arches ascend in a curve, and are attached at their other extremity beneath the cranium, but by means only of cellulosity, or of ligaments. The intermediate chain of bones just alluded to forms, in a certain sense, a continuation of the lingual bone. There are usually three: the first, 53 (see chiefly fig. 4), is attached at the base of the angle formed by the two branches of the hyoid bone; the second, 54, affords attachment to the first pair of arches; and the third, 55, affords the like attachment to the second pair, while the third pair adheres to its extremity; the fourth pair of arches is connected with the angle of the third pair. Each arch is composed of two parts, moveable on each other, and the inferior portion of the first three pair itself consists of two pieces, 57 and 58; in the last pair there is only a single piece, 60. The upper portion of the arches, 61, is simple, except in the first pair, which is usually suspended from the cranium by a small stylus, 59. The inner face of these arches is furnished with small plates or cones of osseous lamina, usually armed with teeth variously disposed according to the species. The most general uses of this armature are to arrest the progress of such substances as the fish is swallowing,—to prevent their escaping with the respired water, or their producing inconvenience amid the interstices of the branchiæ. It may be likened in its functions to the epiglottis of quadrupeds, or the dentations of the margins of the larynx of birds. Besides the interior range of conical plates, the perch possesses an external row of slender pointed teeth, resembling those of a garden rake, upon its first pair of arches, see 63.

Pharyngeal bones. At the entrance to the œsophagus, and immediately below the branchial apparatus, are placed the pharyngeal bones, which produce a second mastication, often more powerful than the first; for this purpose they are armed with teeth of very variable form and number, according to the species. These bones are usually two inferior, 56, and six superior, 62.

Vertebræ. We have already described the general character of the vertebral bones of fishes. Their special forms will be best understood by an inspection of Plate CCXCVII. fig. 1, Nos. 67, 68, 69, with the processes, marked *a, b, c.* The *ribs* are shown at 72; the styles or appendages which frequently adhere to those parts, at 73. In a few fishes the ribs are entirely wanting.

Vertical fins. These are supported by rays composed of an internal portion, named the interspinal, 74, which serves as a sustaining root, by penetrating the flesh among the great lateral muscles, and an external portion, which exhibits the rays *properly so called,* as seen at 75. We sometimes find an interspinal bone which bears no rays, 76. A certain number of these vertical rays are pointed bones, and are then named spines, or spiny rays; others are bony or solid only towards their base, their remainder being formed of a multitude of small articulations, and frequently ramified into lesser branches, themselves still further divided; in these states they are named articulated, soft, or branched rays. Those of the tail, 71, are always soft and articulated; although, towards the root, both above and below, 78, they gradually diminish till only the solid portion of the base remains. In a great number of fishes the vertebra at which the abdomen terminates and the caudal part begins, and even that which follows it, 83, 83, have a great inferior spinous process, to which is joined a more or less voluminous bone, 79, extending behind the anus, and thus forming the posterior boundary of the abdominal cavity.

The *sternum* does not exist in all fishes. When present, it consists of a series of single bones of various configuration, according to the genera, and at these the ribs terminate.

Bones of the shoulder and arm. In osseous fishes, we find on each side, immediately behind the orifice of the gills, a suite of bones, forming a kind of frame, on which the opercle rests when closed. These bones, usually attached to the head from above, and uniting together below, form an osseous belt, surrounding that part of the body. Their inferior symphysis unites by ligaments to the tail of the hyoid bone (formerly mentioned, 42), and forms with it the *isthmus,* which separates the external openings of the gills from each other beneath, just as the cranium separates them above. This cincture, when complete, is composed on each side of three bones, which represent the shoulder and the arm, to which adheres, posteriorly, a group of two or three others, occupying the place of the fore arm, and bearing the pectoral fin, which may be considered as the hand; lastly, there is almost always suspended a style, composed of one or two bones, which Cuvier regards as the analogue of the coracoidian bone. The highest of these first three bones, 46, is usually forked, and attached by its two crests to the lateral crests of the cranium. It is visible externally at the top of the branchial opening, resembling a scale, larger than the others, and is sometimes toothed on its edges. The second, 47, continues along the margin of the branchial opening. The third, 48, always the largest, completes the cincture, by uniting with its counterpart beneath the throat. To the inner surface of the last-mentioned bone adheres a fourth, 51, and fifth, 52, placed one above the other. The free side of these bones bears the pectoral fin, but by means of an intermediate range of four or five small bones, 53. These bonelets may be supposed to represent the carpal series; and if so, then the two others, 51 and 52, will be the cubitus and radius. The third pelled forwards by the rapid flexure of the extremity acting laterally upon the resistance offered by the water. Generally speaking, neither the pectoral nor the ventral fins are of any material use during swift progressive motion; they rather serve to balance the body, or to aid its gentler movements while in a state of comparative repose. In *flying fishes*, as they are called, the pectoral fins are of such great length and expansion as to support the animal in the air; and the strength of muscular action might probably suffice even for a longer flight, but for the necessity of constant moisture for the purposes of respiration. The drying of the gills in an individual of this class is attended by results analogous to those produced by submersion in the case of a land animal;—and a flying fish is obliged to descend to respire, in like manner as a swimming quadruped, or disguised mammiferous animal (as we may term a whale), is under the necessity of ascending for the same purpose.

The head of fishes exercises but a slight movement independent of the rest of the body; but the jaws, hyoid bone, palato-temporal and branchial arches, and pharyngial and opercular bones, are very free in their motions. The muscles of fishes, like those of other vertebrated animals, are composed of fleshy fibres more or less coloured, and of tendinous fibres of a white or silvery colour. With the exception, however, of certain special muscles which are sometimes of a deep red, the flesh of fishes is much paler than that of quadrupeds, and still more so than that of birds. In some species it is even entirely white.

SECT. V.—THE NERVOUS SYSTEM AND SENSES OF FISHES.

The sensitive system of fishes, like that of the higher classes, is composed of the external senses, of a central medullary apparatus, and of nerves of communication. As in the classes alluded to, the central portion of the nervous system, that is, the brain and spinal marrow, occupies the cavity of the cranium and vertebral column.

As fishes respire through the intervention of water alone, that is, as they can scarcely avail themselves, in rendering their blood *arterial*, of any thing more than the small portion of oxygen contained in the air which is suspended in the water, their blood is necessarily cold, and their general energy, and the activity of their senses and movements, are less than among Mammalia and birds. Their brain also, though of similar composition, is proportionally much smaller; and the external organs of the senses do not seem of such a nature as to be capable of impressing or conveying towards it any vivid excitement. Indeed the most striking characteristic of the brain of fishes is its extreme smallness, when compared either with the total size of the body, with the mass of nerves which proceed from it, or with the cavity of the cranium in which it is contained. In the burbot, or *Gadus lota*, the weight of the brain to that of the spinal marrow is estimated by Carus to be as 8 to 12, and to that of the whole body as 1 to 720. It was previously known that the brain of the pike weighed in proportion to that of the whole body as 1 to 1305. Now, in many small birds, the brain, viewed in relation to the rest of the body, is equal to a twentieth part. In the generality of fishes, the spinal marrow extends along the whole of the caudal vertebræ; and it is thus that it preponderates over the brain. The *Lophius piscatorius*, however, and a few other species, form remarkable exceptions to this rule, as in them the spinal marrow disappears before it reaches the eighth vertebra; but in the greater proportion of cases it may be said that the spinal cord in this class terminates by a single thread in the last caudal vertebra.[1] The brain of fishes by no means fills up the cavity of the cranium; and the interval between the pia-mater which envelopes the brain itself, and the dura-mater, which lines the interior of the skull, is occupied only by a loose cellulosity, frequently impregnated by an oil, or sometimes, as in the sturgeon and thunny, by a rather compact grease. It has also been remarked, that this void between the cranium and the brain is much less in young subjects than in adults; from which it may be inferred, that the brain does not increase in an equal proportion with the rest of the body. Cuvier, in fact, has found its dimensions nearly the same in different individuals, of which the general size of the one was double that of the other.

When compared with that of quadrupeds, the brain of fishes has been said to possess an embryonic character, and to have its greatest development in the cerebellum, the seat of the appetites. Of all vertebrated animals, fish in fact exhibit the smallest apparent signs of sensibility. Having no elastic air to act upon, they are necessarily mute, or nearly so; and all the sensations which the delightful faculty of voice has called into being among the higher tribes, are to them unknown. Their glazed immoveable eyes, their fixed and bony faces, their bodies and members moving altogether, if they move at all, admit of little play in their physiognomy, and of scarcely any expression to their emotions. Their ears, surrounded on every side by the bones of the cranium, destitute of external conch, without any internal cochlea, and composed merely of some sacks and membranous canals, scarcely suffice for the perception of the loudest sounds. Even their sight may be supposed to find but little exercise in those profound depths where so many of the inhabitants of ocean dwell, although the largeness of the visual organs in many species probably in some measure makes amends for this deficiency of light. But even in those species the eye cannot change its direction; still less can it alter its focus, so as to accommodate the vision to a varying distance; for the iris neither dilates nor contracts, and the pupil remains for ever the same in all degrees of light. No tear moistens its glazed surface, no eyelid clears or protects it, and it

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bone of the cincture, which supports the two last named, will then necessarily represent the humerus, and the first and second (46–7) the shoulder blade. There still remains to be mentioned a species of style, almost always composed of two pieces, 49 and 50.

Carpal bones. At the outer edge of the radial and cubital bones adhere the small flat bones, 53, compared to the carpus. Their function is to support the rays of the pectoral fin, 53, *a*, however numerous these may be, with the exception of the first, which articulates directly with the radius or upper bone, 52.

Bones of the hinder extremity. The os innominata, the thigh, the tibia, and the tarsus, are represented in fishes by a single bone, 80, usually of a triangular form, but more or less complicated by processes and projecting plates. Its posterior side affords attachment to the rays of the ventral fins. In eels and others, in which the ventral fins are wanting, the bone is also absent.

The rays of the extremities. These rays, that is, those of the pectoral and ventral fins, 82 and 53, *a*, without being as symmetrical as those of the vertical fins, are equally divisible into halves. Except the external ray of the ventral in the Acanthopterygii, 81, they are almost always articulated, but their bases become solid, and there the articulation is scarcely if at all perceptible.

[1] In regard to the shortness of the spinal cord in *Lophius*, the fact, as above referred to, is taken from the dissertation of Apostolo-Arsaki, a Greek doctor, who published *De piscium cerebro et medulla spinali*, Halle, 1813; but in a note to the *Hist. Nat. des Poissons* of Cuvier (vol. i. p. 437), we find the following correction of that statement:—"Sa moelle règne presque tout le long de l'épine; mais elle est enveloppée et cachée par les nerfs, qui naissent beaucoup plus haut qu'ils ne sortent." It is certain, however, from Cuvier's recent statement, that the supposed character is truly exhibited by the *moon-fish* (*Lampris guttatus*, Retz; *opah* of Pennant), "Où la moelle épinière est tellement raccourcie qu'elle ne semble qu'une petite proéminence conique de l'encéphale, de laquelle les différentes paires de nerfs partent comme une queue de cheval." (*Ibid.*)

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consequently offers but a dull and feeble representative of that beautiful and most expressive organ, so full of life and animation in the higher tribes.

The position, direction, and dimensions of the eyes of fishes vary greatly. In some they have an upward aspect, and are often very close upon each other; in others they are lateral, and so wide apart as to be even directed slightly downwards. But of all anomalies, one of the most extraordinary which their position presents, is that of the *Pleuronectes* (such as turbot, flounders, soles, &c.), in which the two eyes are placed, as it were, the one above the other, and both upon the same side of the head. In certain species of the eels and *Siluri*, they are so small as to be scarcely visible; while in other groups, such as *Priacanthus* and *Pomatomus*, they surpass in proportional diameter whatever is known of the same organs in the higher classes. It may be said in general that the eye of fishes is large, and that its pupil especially is broad and open; a character probably connected with the necessity of collecting whatever devious rays of light may penetrate the obscure depth of waters. Fishes have no true eyelids. The skin always passes over the eye, to which it is slightly adherent; and it is for the most part sufficiently transparent for the passage of the solar rays. In some species, such as eels, it passes over without the slightest fold or duplication; while in a few, for example, the *Gastrobranchus cæcus* of Bloch, it continues quite opake, so as entirely to conceal the eye. In others, as the well-known mackerel and herring, it forms an adipose fold both before and behind; but these folds are fixed, and being unprovided with muscles, have no mobility. Sharks have one, somewhat more moveable, on the inferior margin of the orbit. The globe of the eye itself is very slightly moveable, although, like that of man, it is furnished with six muscles. Perhaps the most singular eye presented by the class of fishes is that of *Anableps*, which has two corneæ, separated by an opake line, and two pupils pierced in the same iris, so that one might deem it double; but there is only one retina, and a single vitreous and crystalline humour. In accordance with the general structure of the eyes of fishes (which we shall not further detail), the nearly spherical form of the crystalline humour, the immobility of the pupil, and the difficulty with which it changes the length of its axis, we can scarcely doubt that the vision of this class is comparatively imperfect. Images must be but feebly painted in their retina, and their visual perceptions must be indistinct and dull. At the same time it is evident that they perceive their prey from a considerable distance; and the angler, who knows either how rapidly they seize or how cautiously they avoid his lure, and with what discrimination they sometimes prefer one colour or kind of artificial fly to another, must be impressed with the belief that the power of vision, at least of certain species, is by no means devoid of clearness and precision.

The *organ of hearing* in fishes consists of little more than the labyrinth, and that a much less complicated one than the corresponding part in either quadrupeds or birds. They have no external ear, unless we may bestow that name on a small cavity, sometimes slightly spiral, which we find in the rays. It is however always covered by the skin, and is not perceptible among the osseous fishes. A few of the latter, such as the genus *Lepidoleprus*, and certain *Mormyri*, have merely openings in the cranium closed by the skin, by means of which the vibrations of the element by which they are surrounded may be conducted to the labyrinth. In some other species, as *Myripristis*, the cranium is open beneath, and its orifice is closed by a membranous partition, to which the swimming bladder adheres; but these communications are very different from that which takes place by means of the tympanum, and still more by means of the Eustachian tube in other classes. Both these parts, as well as the bones, are in fact wanting in the class of fishes. Those who find in the bones of the operculum the four bones of the ear of man suddenly and prodigiously developed, hazard such a notion merely on the assumption that the bony pieces are the same in number in all crania; but it must be borne in mind, that neither the form, nor the relations, nor the functions of these bones, nor their nerves nor muscles, support such a comparison. The ear of fishes, then, is much less complete than that of quadrupeds, birds, or even of the majority of reptiles. There is no doubt that they possess the sense of hearing; but it is merely a general sense of sound, and is in all probability incompetent to perceive any variety or range of intonation. In truth, the simple fact of fishes being as a class entirely mute, is of itself a logical ground for believing that their perception of sound is extremely dull.

A few lines may now be devoted to the consideration of the *sense of smell.* The nostrils of fishes are not so placed as to be traversed either by air or water, in connection with the act of respiration. They consist merely of two openings, situate near the extremity of the muzzle, and lined by the pituitary membrane, which is raised in extremely regular folds. In the ordinary fishes, the bones which Cuvier regards as the nasal serve as the arch or covering; while the vomer, the maxillary, and inter-maxillary contribute to sustain the sides, the first sub-orbitary forming the inferior portion. The shape of the nostrils is sometimes oblong, sometimes round or oval. They are placed either at the end of the muzzle or on its sides; sometimes on its superior face, and even occasionally, as in skates and sharks, on its under surface near the angle of the mouth. In the lamprey they are approximate on the top of the head, and open by one common orifice. In the great majority of fishes, perhaps in all the osseous kinds, each nostril opens by two orifices, the one posterior to the other, and in some cases at a considerable distance. These are what are called double nostrils; an inaccurate term, in as far as each pair of holes leads only to a single cavity. The margins of the anterior orifice are often tubular, as in the eel, and sometimes a single side of the tubular margin is prolonged into a tentacular appendage, as in several Siluri. In the genus *Lophius* the nostrils are borne upon a little pedicle, so as somewhat to resemble mushrooms. Various other modifications are observable in different genera, although not necessary to be here narrated. It does not appear, at least in the osseous fishes, that the envelope of the nostrils possesses mobility, or that the orifices are furnished with muscles by means of which they can be opened and shut.

It is certain, however, that fishes possess the faculty of perceiving odours; that various scents attract or repel them; and there is no reason to doubt that the seat of that perception lies in the nostrils. It may be reasonably conjectured that its strength depends mainly on the degree of development produced by the number and extent of the interior folds.

In regard to the *sense of taste* in fishes, it is evident that as, with few exceptions, they swallow their food rapidly and without mastication, their perception of that faculty must be in noways acute. The same may be inferred from the fact of their tongue being almost immoveable, often entirely osseous, or beset with teeth or dental plates, and from its receiving very slender nerves, and these but few in number. Even those species of which the jaws are so armed as to enable them to cut and bruize their aliments, cannot long retain the latter in their mouths, on account of the position and the play of the respiratory organs. No salivary glands discharge their moisture on the organs of taste. The tongue itself is not seldom entirely wanting; and even when it exists in its most distinct and apparently fleshy state, it consists merely of a ligamentous or cellular substance, applied on front of the lingual bone. It is never furnished with muscles capable of producing any movement of extension or retraction, as in quadrupeds.

Fishes cannot be said to be more highly favoured in respect to the *organs of touch* than those of taste. The faculty is greatly deadened over the general surface by the coating of scales, and in the particular members by the inflexibility of the rays. It is chiefly confined to the lips, and even these parts in many species are themselves as hard and insensible as bone. Certain soft and delicate appendages called *barbles*, possessed by many species, such as the cod and loach, are supposed to enjoy a more delicate perception of the sense of touch. It is by means of the *dermis* that that peculiar matter, so remarkable for its silvery metallic lustre, and which bestows so much of brilliancy upon the class, is secreted beneath the scales. It is composed of small polished plates resembling burnished silver, and capable of being removed by washing, either from the skin itself, or from the inferior surface of the scales. It is this substance that is used in the formation of false pearls. It is also secreted by many species in the thickness of the peritoneum, and in the envelopes supplied by that part to particular viscera, especially the swimming bladder. The scales of the majority of fishes are *imbricated*, that is, placed partially over each other, like the tiles or slates of the roof of a house. They are not equally distributed, nor of the same form or consistence, over the general surface of the body. The head is frequently destitute of scales, and those of the lateral line of the body are distinguished from the others by one or more small tubes by which they are perforated, and by other peculiarities.[1]

It thus appears that the external senses of fishes convey to them few lively or distinct impressions; and by whatever scenes in nature they are surrounded, their perceptions are probably indistinct and dull. Their sexual emotions, cold as their blood, indicate only individual wants. Few species pair, or enjoy any connubial gratification, for the males seek the eggs rather than the females which deposit them, and neither sex ever recognises its offspring. At least the exceptions to these generalities are extremely few, and the prevailing economy of fishes may be said in all these respects to be exactly the reverse of that of birds. These gay creatures of the sky have the power of surveying distinctly at a glance an immeasurable extent of horizon; their acute perception of hearing appreciates all sounds, and every intonation; and their glad voices are exquisitely skilled in their production. Though their bills be hard, and their bodies covered by down and feathers, they are by no means deficient in the sense of touch. They enjoy all the delights of conjugal and parental affection, and perform their incumbent duties with devotedness and courage; they cherish and defend their offspring, and will sometimes die in that defence; and of all the wonderful labours of instinctive art, none is so beautiful as the formation of their mossy dwellings. With what deep and continuous affection does the female brood over her cherished treasures! how unwearied is the gallant male in his tender assiduities, and in the rich outpouring of that varied song by which he seeks to soothe her sedentary task! The same principle of attachment and discrimination is even made available in a state of domestication by the skill of all-engrossing man. A bird acquires a knowledge of its master, and submits to and obeys that master's will; and the proud falcon, which in its natural state

> Doth dally with the wind, and scorn the sun,

will wheel in airy circles over a well-trained dog, or stoop its boldest flight at some familiar urchin's call. Other species will even imitate man's noblest faculty, the power of speech,—and it is thus with somewhat doubtful feelings that we deny to them the gift of reason.

But the silent dweller in the deep knows few attachments, expresses no language, cherishes no affections. Constructing no dwelling, he merely shelters himself from danger among the cavernous rocks of the ocean, or beneath the murky shade of the overhanging banks of rivers; and the cravings of hunger seem alone to exercise a frequent or influential action over his monotonous movements. We must not, however, suppose that the life of fishes is not one of enjoyment, for we know that the great Creator "careth for *all* his creatures;" and it ought perhaps rather to be said that we cannot appreciate the nature of their feelings, than that they are in any way fore-doomed to a negation of pleasure. Assuredly, however, the hand of nature has been most prodigal in bestowing on their external aspect every variety of adornment. Their special forms are infinite, their proportions often most elegant, their colours lively and diversified, and nothing seems wanting in them to excite the admiration of mankind. Indeed it almost appears as if this prodigality of beauty was intended solely for such an end. The brightness of metallic splendour, the sparkling brilliancy of precious gems, the milder effulgence of the hues of flowers, all combine to signalise fishes as among the most beautiful objects of creation. When newly withdrawn from their native element, or still gliding submerged in its liquid coolness, their colours, fixed or iridescent, are seen mingling in streaks or bands, or broader flashes, always elegant and symmetrical; sometimes richly contrasted, sometimes gradually softened into each other; and in all cases harmonizing with a chaste fulness of effect, which Titian or Rubens might envy, but could never equal. For what reason, then, it has been asked, has all this adornment been so lavishly bestowed on creatures which can scarcely perceive each other amid the dim and perpetual twilight of the deep? Shakspeare has already said that there are "more things in *heaven* and *earth* than are dream't of in our philosophy;" and we fear it is no answer to the foregoing question to add, that the same observation applies with even greater truth to the "*waters beneath the earth.*"

SECT. VI.—THE NUTRITION, MANDUCATION, AND DEGLUTITION OF FISHES.

The nutritive functions of fishes follow the same order of progression as those of the other vertebrated classes; they seize and in some measure divide their food with their teeth; they digest it in the stomach, from whence it passes into the intestinal canal, where it receives a supply of bile from the liver, and frequently a liquid similar to that of the pancreas; the nutritive juices absorbed by vessels analogous to lacteals, and probably taken up in part also directly by the veins, are mingled with the venous blood which is flowing towards the heart, from whence it is pushed to the branchiæ, in which, coming into contact with the water, it is converted into arterial blood, and then proceeds to the nourishment of the whole body. As in other animals, also, certain properties are carried off from the blood by transpiration, the secreting power of the kidneys, &c.

Fishes in general are extremely voracious, and the rule of "eat or be eaten" applies to them with unusual force. They are almost constantly engaged in the pursuit and capture of their prey; their degree of power in these respects depending of course on the dimensions of the mouth

[1] See *Hist. Nat. des Poissons*, t. i. chap. vi.

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and throat, and the strength of the teeth and jaws. If the teeth are sharp and hooked, they are capable of securing the slenderest and most agile animals; if they are broad and strong, they are able to bruise the hardest aliment; if they are feeble or entirely wanting, they are only serviceable in procuring some inert or unresisting prey. Fishes indeed show but little choice in the selection of their food, and their digestive powers are so strong and rapid as to suffice to dissolve very speedily all kinds of animal substances. They greedily swallow other fishes, notwithstanding the sharp spines or bony ridges with which they may be armed; they attack and devour crabs and shell-fish, gulping them entire if they cannot otherwise attain their object; they do not object occasionally to swallow the young even of their own species, and the more powerful kinds carry their warfare into other kingdoms of nature, and revel on rats, reptiles, and young ducklings, to say nothing of the ferocious shark, which not seldom makes a meal even of the lord of the creation. The species which live chiefly on vegetable substances are few in number.

The growth of fishes depends greatly on the nature and supply of food, and different individuals of the same species exhibit a great disparity in their respective dimensions. They grow less rapidly in small ponds or shallow streams, than in large lakes and deep rivers.[1] The growth itself seems to continue for a great length of time, and we can scarcely set bounds to, certainly we know not with precision, the utmost range of the specific size of fishes. Even among species in no way remarkable for their dimensions, we ever and anon meet with ancient individuals, favourably situated, which vastly exceed the ordinary weight and measurement of their kind.

The teeth of fishes are sometimes spread over all the bones which envelope the cavities of the mouth and pharynx; on the maxillary, inter-maxillary, and palatine bones; on the vomer, the tongue, the branchial arches, and pharyngeal bones. In certain genera they exist on all those parts; while in others they are wanting on some, or are even entirely absent on all. The denominations of the teeth are derived from their position, that is, from the bones to which they are attached, and are consequently as numerous as the varieties of their situation. Their forms are not less varied than their stations, and give rise to terms still more numerous. The majority are conical or hooked, more or less acute. When these hooks are in considerable number, and disposed in several rows, or in quincunx, they are compared to those sharp points which beset the instruments called *cards,* used in the working of wool or cotton. It is to this form and distribution that we allude in the descriptive portion of the present treatise when we happen to use the French term *en carde.* Sometimes the teeth of fishes are slender, and so closely set together as to resemble to the eye the *pile* of velvet, in which case they are said to be *en velours*;[2] when they are at the same time extremely short and close, they are likened to smooth velvet; when feeble and elongated, they are said to be brushy or hair-like. Lastly, those kinds of teeth are sometimes so extremely small and short as to be reduced to mere asperities, sensible rather to touch than sight. The whole are simple, and spring from an equally simple pulpy germ.

In the majority of osseous fishes, besides the lips, which, even when fleshy, having no peculiar muscles, can exert but little strength in retaining the aliments, there is generally in the inside of each jaw, behind the anterior teeth, a kind of membranous fold or valvule, formed by a replication of the interior skin, and directed backwards, of which the effect is to hinder the alimentary substances, and especially the water gulped during respiration, from escaping again by the mouth. This structure, as formerly supposed, does not constitute a character restricted to the genus *Zeus*, but exists in an infinity of fishes. The food seized by the teeth of the maxillæ, and detained by the valve just mentioned, is carried still farther back by the teeth of the palate and tongue when these exist, and is at the same time prevented by the dentations of the branchial arches from penetrating between the intervals of the branchiæ, where it might injure the delicate organs of respiration. The movements of the maxillæ and tongue can thus send the food only in the direction of the pharynx, where it undergoes additional action on the part of the teeth of the pharyngeal bones, which triturate or carry it backwards into the œsophagus. The last-named part is clothed by a layer of strong, close-set, muscular fibres, sometimes forming various bundles, the contractions of which push the alimentary matter into the stomach, thus completing the act of deglutition.[3]

SECT. VII.—THE CIRCULATION OF FISHES.

Fishes, in common with warm-blooded animals, are provided with a complete circulation for the body, and with another equally complete for the organs of respiration, and with a particular abdominal circulation terminating at the liver by means of the vena porta; but their peculiar character consists in this, that the branchial circulation alone is provided at its base with a muscular apparatus or heart, corresponding to the right auricle and ventricle of the higher classes, while nothing of the kind exists at the base of the circulating system of the body; in other words, the left auricle and ventricle are entirely wanting—the branchial veins changing into arteries without any muscular envelope.

The muscular apparatus of their circulation is composed of the auricle, the ventricle, and the bulb of the pulmonary artery, and the auricle itself is preceded by a large sinus, in which all the veins of the body terminate; a structure which gives rise to four cavities separated by restrictions, into which the blood must flow in its progress from the body to the branchiæ. Their size is small in proportion to the dimensions of the body, and does not increase in the same ratio with the growth of the individual. Three of these receptacles, the auricle, the heart, and the bulb, are lodged in a pericardium, which is itself placed beneath the pharyngeal bones, between the inferior parts of the branchial arches, and for the most part protected externally by the humeral bones. The great venous sinus is not placed in the pericardium, but between the posterior partition of that cavity and the membrane which represents the diaphragm,

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[1] The writer of this treatise kept a minnow little more than half an inch long in a glass tumbler for a period of two years, during which time there was no perceptible increase in its dimensions. Had it continued in its native stream, subjected to the fattening influence of a continuous flow of water, and a consequent increase in the quantity and variety of its natural food, its cubic dimensions would probably have been twenty times greater; yet it must have attained, prior to the lapse of a couple of years, to the usual period of the adult state.

[2] The French expression of *dents en velours*, which so frequently occurs both in the *Règne Animal* and the *Hist. Nat. des Poissons*, is one of the many instances, as Dr M'Murtrie has remarked, in which Baron Cuvier's expressions bid defiance to all English synonyms.

[3] The various notices (as already intimated) of the internal structure of fishes contained in the article COMPARATIVE ANATOMY of this work (vol. iii.) absolve us from the propriety of presenting any details regarding the form and constitution of the intestinal canal, and of certain other important interior organs of the class.

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and which is merely the anterior portion of the peritoneum strengthened by aponeurotic fibres. This sinus is extended transversely, and receives by several different trunks the veins of the liver, of the generative organs, of the kidneys, of the fins, branchiæ, and throat, and finally those of the head, which themselves partly pass by a sinus at the back of the cranium. The first-mentioned sinus sends the whole of this blood by a single orifice of its anterior convexity into the auricle, which receives it through the opening of its anterior portion. Two thin membranous valvules protect this communication, and are turned towards the auricle. The latter organ is placed in the pericardium, in front of the great sinus, and above the ventricle, that is, on its dorsal aspect. It presents very various and often remarkable configurations. In osseous fishes it is usually of a tetrahedral form,—in the cartilaginous kinds more frequently rounded and depressed. It is situate beneath the auricle, the cavity being so turned as to be almost vertical next that organ, and horizontal towards the bulb. Its coats are extremely robust, and furnished internally with powerful fleshy columns, its substance being composed of two different layers. But it is in the bulb of the branchial artery that we find the most vigorous fibres, usually disposed in a circular form. The prolongation of this bulb issues from the pericardium, and becomes the branchial artery, advancing forward beneath the single chain of small bones which unites the arches of the branchiæ. The branchial artery soon divides, and in such a manner as to send a branch to each branchia. These branches pass along a hollow groove on the convexity of each branchial arch, and more external than the vein which follows the same track, but in an opposite direction. To the arch are attached a great number of leaflets, parallel to each other, usually terminated in a forked point, and sometimes deeply divided. The principal branch which passes along the groove of the arch gives a smaller branch to each of the leaflets; and this branch, after being twice bifurcated, furnishes an infinity of lesser branchlets, which meander over the surface of each leaflet, till they are finally converted into extremely minute veins. These little vessels meet on each side in a branchial vein, which proceeds along the internal margin of the lateral lobe of the leaflet, and the two veins open into the trunk of the great vein of the branchia.

On passing out of the dorsal side of the branchia, the branchial veins assume the structure and functions of arteries; even before their arrival at this point, the anterior have already sent several branches to different portions of the head; and it is necessary to remark, that the heart and several parts situate in the chest receive their blood from a branchial vein, by means of an offset issuing from near its source, and consequently anterior to its exit from the branchiæ. Nevertheless, it is only by the re-union of the trunks proceeding from the four branchiæ that the great artery is formed which carries the blood to the viscera and all the parts of the trunk, and which is by consequence the representative of the aorta of the Mammalia,—but of an aorta which possesses neither auricle nor ventricle at its base. Thus, according to Cuvier's views, the left cavities of the heart of quadrupeds do not exist in fishes, but are replaced by a simple vascular apparatus, situate above the branchiæ, in like manner as the right cavities are placed beneath them.

SECT. VIII.—THE RESPIRATION OF FISHES.

It is thus by an almost infinite subdivision of the vessels over the surface of the branchiæ or gills, that the blood of fishes becomes subjected to the influence of an ambient fluid. This fluid is of course water, which is made to flow incessantly between the branchiæ by the movement of the jaws, and of the opercular and hyoidean apparatus. This mode of respiration is equally necessary to fishes, as the direct respiration of air is to other animals; but the action of water on the blood is much more feeble than that of air. It appears that it is neither the water itself, nor the oxygen contained in it, which effects the respiration, but the small portion of air which is held in solution or mingled with the water. If this is expelled by ebullition, fishes cannot live; and many species are obliged to rise frequently to the surface for the purpose of breathing atmospheric air. It is easy to suffocate various kinds, by keeping them beneath the surface, enclosed in a gauze net. In the respiration of fishes, as in that of other animals, both the atmospheric air and that contained in the water give out their oxygen. The absorption of the latter, however, is very trifling among these aquatics, for it has been calculated that a man consumes fifty thousand times more than is required by a tench. When fishes are deprived of water, they perish not so much for want of oxygen, as because their branchiæ become dry, and their blood can no longer circulate with freedom. Hence the species of which the branchial orifice is small, as the eel, or those which possess receptacles for moisture, like *Anabas* and *Ophicephalus*, long survive exposure; while such as have their gills greatly cleft and open, as the herring, expire almost instantly when withdrawn from their moist abode.

SECT. IX.—THE SWIMMING BLADDER OF FISHES.

One of the most remarkable and characteristic organs of fishes is the swimming bladder, commonly so called. In many genera it has no opening or external communication, and the air which it contains must therefore be the result of secretion. It is composed of an extremely fine internal tunic, and of another of a thicker texture and peculiar fibrous structure, remarkable for producing the finest kind of isinglass. It is enclosed within the general coating with which the peritoneum invests the other viscera. It is sometimes simple, as in perch, sometimes furnished with more or less numerous appendages, as in some of the haddock tribe, or branched, as in certain *Sciænæ*.[1] Occasionally we find it divided, as it were, into two parts, by a restriction, as in the genus *Cyprinus*, many of the *Salmonidæ*, and others. The *Catastomæ* have it even divided into three. It is chiefly among the abdominal fishes that we find it communicating by a tube or tunnel with the intestinal canal, and either directly with the œsophagus, as in *Cyprinus*, or with the base of the stomach, as in the herring. That of the sturgeon opens into the former portion by means of a large orifice. The contents of the swimming bladder are usually found to be azote, mingled with some fractional parts of oxygen or carbonic acid. A difference of opinion, however, seems to exist regarding the proportion of oxygen, which is estimated as much greater both by Configliachi and Biot. Some physiologists appear to have regarded the swimming bladder as a true lung, which both admitted and returned the external air; but in many species the air-duct which connects the bladder with the gullet is entirely wanting; and in many others which remain constantly at prodigious depths, the quantity of oxygen gas in the swimming bladder is greater than in those the abode of which is near the surface. Indeed the oxygen is said to increase in quantity in proportion to the depth at which the species dwells. Carus considers it probable that the vessel in question performs a part analogous

[1] For representations of various forms of the swimming bladder of fishes, see Plate CCXCVII. figs. 3, 6, 7, 8.

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to that of the expiratory functions of the lungs in the higher classes, by not only separating excrementitious azote and superabundant oxygen from the blood, but even discharging those elements in such species as have this particular viscus provided with an air-duct.

The more obvious use, however, of this organ seems to be to maintain the fish in equilibrium, or to lighten or increase its relative weight, so as to cause an ascension or a sinking, in proportion as the bladder is compressed or expanded. This is probably effected by the contraction or dilatation of the ribs. At all events, it is certain, that when the air-bladder bursts, the fish remains at the bottom, usually turning up its belly, and exhibiting other irregularities in its locomotion. Another curious effect is observable in regard to fishes which have been suddenly brought from a great depth by means of a long fishing line, and which having no time either to compress or partially empty the organ in question, the air which it contains being no longer pressed by the heavy weight of water, either expands so as to burst the bladder, or by its dilatation forces the stomach and œsophagus into the fish's mouth. When the air-bladder is pierced artificially, the fish almost immediately turns upon its back, and sinks to the bottom.

We have already alluded to the physiological opinion which regards this organ as an auxiliary to the respiratory system, and have likewise adverted to the argument against that opinion, deduced from the fact of its being imperforate in many species, and entirely wanting in others. We may add, that Weber[1] has pointed out a remarkable connection between the swimming bladder and the organs of hearing. It would appear that the former in several instances subserves the latter as a membrana tympani; but its primary, or at least most important purpose, seems to be to regulate the ascending or descending movements. Though of the highest importance in the structure of such species as possess it (and these are by far the greater number), yet the swimming bladder is not indispensable in the general economy of the class of fishes. In several genera (*e. g. Pleuronectes*) it is entirely wanting, and the species in such cases generally remain at the bottom, and, swimming obliquely on one side, propel themselves forward by a nearly vertical motion of the tail. In such cases both eyes are on the same side, and the whole structure of the fish, especially the skeleton of the head, presents an unsymmetrical aspect of a very extraordinary kind.[2] In many cartilaginous fishes, such as rays (commonly called skates), the absence of the swimming bladder seems compensated by the enormous size of the pectoral fins, which, of all the external organs, are probably the most efficient in raising the body, as the caudal extremity is the power chiefly employed during an onward course. The lamprey, which has neither swimming bladder nor pectoral fins, dwells in the mud. Flat fishes being unprovided with swimming bladders, are supposed for that reason to raise themselves with difficulty to the surface; and they do not appear to strike the water laterally like other fishes, but swim rather after the manner of the Cetacea, by a motion alternately up and down. In all the other animals of this class the chief organ of progressive motion is the tail, or prolongation of the body, terminated by a caudal fin, the position of which, unlike that of the great aquatic mammalia called whales, is vertical. The reason of the difference is obviously this: A true fish, possessing the power of extracting air from water by means of its gills, does not (except at rare intervals) require to mount to the surface for the performance of the vital act of respiration; but all cetaceous animals being furnished with lungs, which cannot perform their functions except through an immediate communication with the atmosphere, require their bodies to be terminated by a horizontal expansion, the action of which is the most efficient for an ascending course.

It is, however, difficult to account for the fact that so considerable an organ as the swimming bladder should have been denied to so many species, not only of the more indolent kinds, which dwell composedly at the bottom of the waters, but to many others which yield to none of their class in the ease and velocity of their movements. Its presence or absence does not even accord with the other conditions of organization; for while it is wanting in the common mackerel, it is found to occur in a closely allied species, the *Scomber pneumatophorus* of Laroche.

Another singular peculiarity connected with the organization of certain fishes may be also shortly noticed in this place, we mean the power of conveying electrical shocks. In Torpedos, the apparatus consists of membranous tubes filled with mucous matter, divided by transverse chambers closely set together, like the cells of honeycomb, and disposed in two groups placed on each side of the head. They receive enormous branches of nerves from the fifth and eighth pair. In the *Gymnotus* this extraordinary structure occupies the under surface of the body throughout its entire extent, and to a considerable thickness. It is composed of parallel plates separated by thin layers of mucilage. The effect of this natural galvanic pile will be detailed in the course of the systematic portion of this article, when we shall have occasion to mention the electric fishes in their proper place.

SECT. X.—THE GENERAL POSITION AND RELATIONS OF FISHES, CONSIDERED AS A GREAT CLASS IN THE ANIMAL KINGDOM.

It results not less from this general exposition of the structure of our present class, than from all observation of special organization, that fishes form a class of animals distinct from every other, and destined by the totality of their conformation to live, move, and have their being in the waters. The liquid element forms their proper place in the creation; there they had their origin, there they must remain till the final consummation of all things,—and it is either through slight and superficial approximations, or by vain metaphysical speculation, that any modern writer could regard them as proceeding from an exalted or more perfect development of the molluscous tribes. Equally unfounded is of course that other and corresponding opinion, which, in the spirit of the same philosophy, looks upon fishes as forming an elementary stage, or fœtal condition, of the other vertebrated classes. It is true that the Mollusca, in common with fishes, respire by means of branchiæ; they equally possess a nervous and circulating system, an intestinal canal and a liver; "and nobody," says Cuvier, with a justifiable pride, "knows these things better than I, who was the first to make known with any degree of completeness the anatomy and zoological relations of the molluscous tribes." As animal life, he continues,[3] has received but a limited number of organs, it necessarily happens that some of these organs are common to several classes. But where is in other respects the resemblance? The skeleton of these animals, and their entire system of locomotion, are they comparable in the least of their parts? And even such organs as are

[1] *De Aure et Auditu*, &c.

[2] In several insects of the genus *Blatta* we have observed a want of symmetry both in the size and markings of the elytra. We do not mean an accidental variation of one side, but an evidently pre-ordained disparity of form and colour.

[3] *Hist. Nat. des Poissons*, t. i. p. 544.

common alike to the Mollusca and to fishes, can they be brought into relation with those connections which the latter exhibit with the other vertebrated classes? By what passage does nature conduct us from the one to the other? It is certainly by no means difficult, while disregarding numerous disagreements, so to compose a definition as to embrace only those points which they possess in common; but that definition assuredly will always repose upon a pure abstraction of the mind, a definition simply nominal, an assemblage of vain words, which can never be represented by a harmonious and existing plan, notwithstanding whatever extraneous details may be collected or conceived in support of such visionary views. By a like procedure, there is in truth no two things, however remote or dissimilar, which may not be so allied; for, whatever their disresemblance, there will always be some particular point or other in which they may be found to agree. But when we look to the characters in which objects differ, we shall find reason to view the subject in another light. The heart itself in those Mollusca which have only one, is placed in a contrary mode from that of fishes; it is at the junction of the branchial veins and arteries of the body that that organ is attached; in several the members are placed upon the head, in others the generative system is lateral, and frequently the respiratory organs are placed above those of digestion, and extend more or less over the dorsal surface. Perhaps all that can be said regarding any positive or important relationship between Mollusca and fishes is, that both classes are possessed of branchiæ.

It may indeed be observed, that whenever we proceed from these purely verbal or metaphysical formula, we find ourselves lost among the most inadmissible comparisons. According to one theorist, the shells of bivalves represent the opercula of fishes; according to another, the buckler of the cuttle-fish is a true fibrous bone; according to a third, the large scales of the sturgeon, and the spines of the diodons, are to be regarded as an external skeleton. Others search for the desired analogies among the Crustacea, of which the margins of the thorax represent the opercula. Beneath these margins the branchiæ actually occur, but if we continue the comparison, all is changed. The medullary cord is towards the abdomen, the heart towards the back, and the latter organ, as among the Mollusca, receives the blood from the branchiæ, but does not send it thither. Finally, some observers, apparently despairing of their transcendental cause, perceive the rays or spiny apophyses of vertebrated animals in the legs of the Crustacea, forgetting that, were it so, an obvious degradation rather than amelioration of organic structure must have befallen the class of fishes.

The affinity of fishes to other classes of vertebrated animals is much better founded. At least we here find the commencement of sensible relations in the number of organic systems, and in their mutual connections; but we are still far from discovering a progressive and continuous course. We cannot in this place report the conclusive reasoning of Baron Cuvier regarding the distinctions of these classes. We shall merely state his conclusion to be, that if there is a resemblance between the organs of fishes and those of the other great groups of the animal kingdom, it is only in so far as the functions of such organs are similar; that if we assert either that fishes are Mollusca of an ameliorated or higher grade, or that they represent a commencing or fœtal state of reptiles, we can do so only in an abstract or metaphysical acceptation, and that even with that restriction we by no means convey an accurate notion of their organic structure; that we cannot regard them either as links of an imaginary chain of successive forms (of which none could serve as the germ of another, since none is capable of a solitary or isolated existence), nor of that other chain, not less fanciful, of simultaneous and transitionary forms, which has no reality but in the imagination of certain naturalists, more poetical than observant. They pertain in truth, and solely, to the actual chain of co-existent beings,—of beings necessary to each other, and which by their mutual action maintain the resplendent order and harmony of created things.

> These are thy glorious works, Parent of good,
> Almighty! Thine this universal frame,
> Thus wondrous fair; Thyself how wondrous then!
> Unspeakable, who sitt'st above these heavens,
> To us invisible, or dimly seen
> In these thy lowest works; yet these declare
> Thy goodness beyond thought, and power divine.

SECT. XI.—THE CLASSIFICATION OF FISHES.

The class of fishes is of all others the most difficult to divide into orders, according to fixed and perceptible characters. We shall here give a brief view of Baron Cuvier's arrangement, the details of which we shall afterwards exhibit in our systematic view.

Fishes are divisible, in the first place, into two great and distinct series, viz. FISHES PROPERLY SO CALLED, embracing the great majority of species; and CHONDROPTERYGIAN or CARTILAGINOUS FISHES, such as sharks and rays.

The general character of the latter series consists in the absence of the bones of the upper jaw, the place of which is supplied by those of the palate. Their entire structure also exhibits sundry analogies, to be afterwards described. Cartilaginous fishes are further divisible into three principal orders.

1*st.* CYCLOSTOMI, the jaws of which are soldered into an immoveable ring, and the branchiæ open by means of numerous holes. Example, the *Lamprey.*

2*d.* SELACHII, which possess the branchiæ of the Cyclostomi, but not their jaws. Example, *Sharks.*

3*d.* STURIONES, of which the branchial opening is in the usual fissure-like form, and furnished with an opercle. Example, *Sturgeons.*

The other great series, or that of the ORDINARY FISHES, presents a first subdivision into those in which the maxillary bone and the palatine arch are fixed to the cranium. They constitute Cuvier's order PLECTOGNATHI, which comprises two families, the GYMNODONTES and SCLERODERMI. Examples, the genera *Diodon* and *Ostracion.*

The next subdivision of the ordinary fishes contains certain species with perfect jaws, but the branchiæ of which, instead of being comb-shaped, resemble a series of small tufts. They constitute an order called LOPHOBRANCHII, which comprises the two genera SYNGNATHUS and PEGASUS of Linn. Example, the *Pipe-fish.*

Of the ordinary fishes there then remains an immense assemblage, to the general classification of which no other characters can be applied than those of the external organs of motion. After a long and laborious research, Baron Cuvier became satisfied that the least objectionable of these characters is still that long ago employed by Ray and Artedi, drawn from the nature of the first rays of the dorsal and anal fins. Thus the great body of the ordinary fishes is divided into MALACOPTERYGII, in which all the rays are soft, with the occasional exception of the first of the dorsal, or of the pectorals; and ACANTHOPTERYGII, in which the first portion of the dorsal, or the first dorsal if there are two fins of that kind, is always supported by spinous rays, and where some similar spines are also found in the anal fin, and at least one in each of the ventrals.

Of these two last-mentioned groups, the former, or

Malacopterygii, may be conveniently subdivided according to the position of the ventral fins, whether situate behind the abdomen, suspended to the apparatus of the shoulder, or entirely wanting. This view furnishes us with three great orders, the MALACOPTERYGII ABDOMINALES (such as pike, salmon, and herring), the M. SUBBRACHIATI (such as cod, haddock, and flat fish), and the M. APODES (such as eels).

But such a basis of subdivision is altogether inapplicable to the remaining group of ordinary fishes, viz. the ACANTHOPTERYGII, which at present can only be placed together in a certain series of natural families. Fortunately, several of these families are possessed of characters almost as precise as those which could be assigned to genuine orders. It is, however, impossible to assign to the families of fish the same marked gradation so perceptible among those of the Mammalia. Thus the Chondropterygians are related to serpents on the one hand by the organs of the senses, and in certain cases even by the generative system; while, on the other, they bear an alliance to the Mollusca and worms in the occasional imperfection of their skeleton.

Before proceeding with our systematic exposition of the minor divisions, we shall present our readers with a sketch of Baron Cuvier's views regarding the general character and relations of certain groups. After forty years devoted to the study of Ichthyology, that great observer became convinced that no acanthopterygian species ought to be mingled in classification with the fishes of other families, as attempted by many of his predecessors; and he also came to the conclusion that the acanthopterygian order, which comprises about three fourths of the entire class, contains the characteristic type, and is the most accordant and homogeneous, even amid all the variations which it undergoes.

The acanthopterygian character prevails over all the others, and these ought to be employed only as subservient to it, and never in opposition; but the extreme constancy of the general plan, and the predominating influence of the regulating character, render it a matter of greater difficulty to apply precise and perceptible characters of a subordinate nature. It is thus that the various families of the acanthopterygian order pass so insensibly from one to another, that we are often at a loss to define the transition. The family of Percidæ, for example, which is essentially distinguished from that of the Sciænidæ by its palatinal teeth, comprises a group of some extent, and extremely natural in its construction, which yet contains a portion of species possessed of those teeth, while the other portion is without them. The same thing happens in the family with mailed cheeks (joues cuirassées), the majority of which are allied to the perches,—the others to the Sciænidæ. The sciænoid genera themselves approach in part to the Chætodontes in the scales which in several instances more or less cover their vertical fins, and yet it is necessary to assimilate them still more closely to the Sparidæ, by reason, in many other instances, of the entire absence of those scales.

The malacopterygian families are distinguished by stronger and more obvious differences, and several of them are not only natural, but subjected to fixed limits, so that each, in its separation from the other, preserves within itself a great resemblance in details. This precision is so sensible, that the majority of natural families established by Cuvier in this part of the class had been already signalised by Artedi as generic groups. His *Siluri*, *Cyprini*, *Salmones*, *Clupeæ*, and *Esoces*, may remain unbroken, and there is even no inconvenience in distributing them according to the position of the ventral fins, because in those genera the character in question, however trivial in itself, is constant; but it is clearly impossible to preserve the distinction of jugular, thoracic, and abdominal fishes, in the mode established by Linnæus. It is, as Cuvier observes, of small consequence, in fact, whether the ventrals manifest themselves externally a little before or a little behind the pectorals, or immediately beneath them; but the circumstance of importance, as connected with the structure of the fish, is to ascertain whether the pelvis be attached to the bones of the shoulder, or whether it is simply suspended in the muscles of the abdomen. To designate the fish belonging to the former category, the name of *Sub-brachians* has been bestowed by Cuvier, and that without any reference to the external position of the ventrals,—that circumstance being dependent on the greater or less extent of the bones of the pelvis. To those of the second category he leaves the older name of *Abdominals.* Lastly, the term *Apodes* naturally designates the Malacopterygians destitute of ventral fins.

Cuvier's systematic exposition of fishes commences with the Acanthopterygians, which constitute in reality only a single family of vast extent. He then places in succession the various families of Malacopterygians, in the order in which they seem allied to the preceding great division; but he guards the student from inferring that these relations follow only in a single line or series. If the abdominal Malacopterygians may be so arranged, and may even be made to commence with those which possess some spiny rays, they are not followed in so natural a succession by either the apodal or sub-brachian tribes. The *Gadi*, for example, are as nearly related as any of the Abdominals to certain species of the acanthopterygian order, and there would be no reason for placing them after the Abdominals if the question were mooted respecting the station they should hold in nature. If they are actually arranged subsequent to the latter in our systems, it is because the exposition of facts in a book necessarily requires a successive order.

The spirit of the same observation is applicable to the rest of the fishes;—to those of which the upper jaw is fixed (*Plectognathi*),—to such as have tufted branchiæ (*Lophobranchii*),—and, above all, to the great and important series of Chondropterygians, which terminate the class. It is indeed chiefly among those last mentioned that we perceive the futility of whatever system seeks to arrange the objects of creation in a single line. Several of the genera alluded to, the rays and sharks, for example, may be said to rise above the rank of ordinary fishes by the complicated nature of some of their organs of sense, and by that of the generative system, which is more fully developed in some particulars than even that of birds;—while other genera of the same series, and at which we arrive by graduated transitions, such as the Lampreys and Ammocætes, become so simplified in their structure, that they have even been regarded as affording a connecting link between the class of fishes and that of the articulated worms. The genus *Ammocœtes* certainly possesses no skeleton, and its muscular apparatus is attached solely to tendinous or membranous supports.

Let it not therefore be imagined, says Cuvier, that because one genus or family is placed anterior to another, it is for that reason to be regarded as more perfect, or superior to those that follow. He alone will indulge in that fond fancy, who pursues the chimerical project of ranging beings in a single series,—a project, be it remembered, now renounced by philosophy. The further we advance into the penetralia of the temple of nature, the more we shall feel convinced that a falser notion was never entertained in relation to natural history. Genuine systems view each being not as intermediate merely to two others, but as central among many;—they show the wonderful radiations that link it more or less immediately with the vast web of organic life; and it is by such extended views alone that

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we shall acquire ideas worthy of nature and of nature's God. It is therefore not so much in the position which a being occupies in our published systems, which are necessarily linear or consecutive, that we are to seek for those multifarious relations, or for the actual degree of organisation,—but in accurate descriptions of structure afforded by those who possess the use of their eyes and pen. It is not, however, to be in any way maintained that no direct classification is possible, or that species should not be formed into groups, and embraced by definitions. These approximations are on the contrary so real, that the natural understanding of man has ever inclined towards them, and in all ages and countries the vulgar as well as the learned have formed their genera. It is in truth one of the great objects of science to render the various groups into which, for our own convenience, we must arrange the objects of creation, as natural in themselves, and as nearly related to their neighbours, as is consistent with the necessity of placing them in our descriptive systems in a single fixed position,—a position, be it remembered, in which their numerous and mixed relations can neither be philosophically exhibited nor fully expressed.

We here terminate our introductory chapter, or general exposition of the class of fishes, and shall now proceed to a detailed enumeration of the characters of the principal genera, adding, as occasion requires, a succinct description and history of the most interesting or important species. We give in a note below a tabular abstract of the Ichthyological System.[1]

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[1] *Systematic View of the Orders, Families, Genera, and Sub-genera of Fishes, according to the arrangement of Baron Cuvier.*

N. B.—In this abstract we follow the system of the *Règne Animal*, as sufficing for a tabular view ; but in the body of our article we shall introduce notices of such new or amended genera as have been signalised by our illustrious guide in those volumes of the *Hist. Nat. des Poissons*, which have made their appearance posterior to the publication of the second edition of the *Animal Kingdom*.

CLASS FISHES.

First Great Series, called ORDINARY or OSSEOUS FISHES.

ORDER I.—ACANTHOPTERYGII.

FAMILY I.—PERCIDÆ.

With thoracic ventrals.

Seven branchial rays, two dorsals, teeth small and crowded.

Perca.
Labrax.
Lates.
Centropomus.
Grammistes.
Aspro.
  Huro.
  Etelis.
  Niphon.
  Enoplosus.
  Diploprion.
Apogon.
  Cheilodipterus.
  Pomatomus.

Some of the teeth long and pointed.

Ambassis.
Lucio-Perca.

With a single dorsal, and canine teeth.

Serranus.
  Serranus proper.
  Anthias.
  Merrus.
Plectropoma.
Diacope.
Mesoprion.

With a single dorsal, and small crowded teeth.

Acerina.
Rypticus.
Polyprion.
Centropristis.
Gristes.

With less than seven branchial rays.

A single dorsal, and some canine teeth.

Cirrhites.

A single dorsal, all the teeth small and crowded.

Chironemus.
Pomotis.
Centrarchus.
Priacanthus.
Dules.
Therapon.
  Datnia.
Pelates.
Helotes.

Two dorsals.

Trichodon.
Sillago.

With more than seven branchial rays.

Holocentrum.
Myripristis.
Beryx.
Trachicthys.

With jugular ventrals.

Trachinus.
Percis.
Pinguipes.
Percophis.
Uranoscopus.

With abdominal ventrals.

Polynemus.
Sphyræna.
Paralepis.
Mullus.
  Mullus proper.
  Upeneus.

FAMILY II.—BUCCÆ LORICATÆ, OR MAILED CHEEKS.

Trigla.
  Trigla proper.
  Prionotus.
  Peristedion.
  Dactylopterus.
Cephalacanthus.
Cottus.
  Cottus proper.
  Aspidophorus.
Hemitripterus.
Hemilepidotus.
Platycephalus.
Scorpæna.
  Scorpæna proper.
  Tænianotes.
  Sebastes.
Pterois.
Blepsias.
Apistus.
Agriopus.
Pelor.
Synanceia.
Menocentris.
Gasterosteus.
Oreosoma.

FAMILY III.—SCIÆNIDÆ.

With two dorsals.

Sciæna.
  Sciæna proper.
  Otolithus.
  Ancylodon.
  Corvina.
  Johnius.
  Umbrina.
  Pogonias.
Eques.

With one dorsal, and seven branchial rays.

Hæmulon.
Pristipoma.
Diagramma.

With less than seven branchial rays, the lateral line continuous.

Lobotes.
Cheilodactylus.
Scolopsides.
Micropterus.

With less than seven branchial rays, the lateral line interrupted.

Amphiprion.
Premnas.
Pomacentrus.
Dascyllus.
Glyphisodon.
Heliasus.

FAMILY IV.—SPARIDÆ.

Sparus.
Sargus.
Chrysophris.
Pagrus.
Pagellus.
Dentex.
  Pentapoda.
  Lethrinus.
Cantharus.
Boops.
Oblada.

FAMILY V.—MENIDÆ.

Mæna.
Smaris.
Cæsio.
Gerres.

FAMILY VI.—SQUAMMIPENNES.

Chætodon.
  Chætodon proper.
  Chelmon.
  Heniochus.
  Ephippus.
    Taurichtes.
  Holocanthus.
    Pomocanthus.
  Platax.
Psettus.
Pimelepterus.
Dipterodon.
Brama.
Pempheris.
Toxotes.

FAMILY VII.—SCOMBERIDÆ.

Scomber.
  Scomber proper.
  Thynnus.
  Orcynus.
  Auxis.
  Sarda.
  Cybium.
  Thyrsites.
  Gempylus.
Xiphias.
  Xiphias proper.
  Tetrapturus.
  Makaira.
  Histiophorus.
Centronotus.
  Naucrates.
  Elacates.
  Lichia.
  Trachinotus.

FIRST GREAT SERIES OF THE CLASS OF FISHES.

ORDINARY OR OSSEOUS FISHES.

ORDER I.—ACANTHOPTERYGII.

These, as already mentioned, form much the most numerous division of the class. They are distinguished by the spines, which occupy the place of the first rays of the dorsal fin, or which alone sustain the anterior dorsal when there are two. Sometimes, instead of an anterior dorsal, there are only a few free spines. The first rays of their anal fin are also spinous, and there is generally one of a similar nature to each of the ventrals. The Acanthopterygians bear so many relations to each other,—their several natural families exhibit so many variations in the apparent characters which one might suppose capable of indicating orders or other subdivisions,—that it has been found impossible to divide them, otherwise than by those natural families themselves, which are thus left without any higher combinations.

FAMILY I.—PERCIDÆ.

So named because well typified by the common perch. Their bodies are of an oblong form, covered with scales, which are generally hard and rough; the opercle and preopercle, and frequently both, have the margins toothed or

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Rhinchobdella.
Macrognathus.
Mastacembelus.
Notocanthus.
Seriola.
Nomeus.
Temnodon.
Caranx.
Caranga.
Citula.
Vomer.
Olistus.
Scyris.
Blepharis.
Gallus.
Argyreiosus.
Vomer proper.
Zeus.
Zeus proper.
Capros.
Lampris.
Equula.
Mene.
Stromateus.
Pampla.
Peprilus.
Luvarus.
Seserinus.
Kurtus.
Coryphæna.
Coryphæna proper.
Caranxomorus.
Centrolophus.
Astrodermus.
Pteraclis.

FAMILY VIII.—TÆNIOIDÆ.

The muzzle elongated, teeth strong.

Lepidopus.
Trichiurus.

The muzzle short, mouth small.

Gymnetrus.
Stylephorus.

The muzzle short, mouth cleft, head obtuse.

Cepola.
Lophotes.

FAMILY IX.—THEUTIDÆ.

Siganus.
Acanthurus.
Prionurus.
Naseus.
Axinurus.
Priodon.

FAMILY X.—LABYRINTHIFORM PHARYNGEALS.

Anabas.
Polyacanthus.
Macropodius.
Helostoma.
Osphromenus.
Trichopodus.
Spirobranchus.
Ophicephalus.

FAMILY XI.—MUGILIDÆ.

Mugil.
Tetragonurus.
Atherina.

FAMILY XII.—GOBIDÆ.

Blennius.
Blennius proper.
Pholis.
Myxodes.
Salarias.
Clinus.
Cirrhibarba.
Gunellus.
Opistognathus.
Zoarcus.
Anarrhicas.
Gobius.
Gobius proper.
Gobioides.
Tænioides.
Periopthalmus.
Eliotris.
Callionymus.
Trichonotus.
Comephorus.
Platypterus.
Chirus.

FAMILY XIII.—PECTORALES PEDICULATI.

Lophius.
Lophius proper.
Chironectes.
Malthe.
Batrachus.

FAMILY XIV.—LABRIDÆ.

Labrus.
Labrus proper.
Cheilinus.
Lachnolaimus.
Julis.
Anampses.
Crenilabrus.
Coricus.
Epibulus.
Clepticus.
Gomphosus.
Xirichthys.
Chromis.
Cychla.
Plesiops.
Malacanthus.
Scarus.
Calliodon.
Odax.

FAMILY XV.—FISTULARIDÆ.

Fistularia.
Fistularia proper.
Aulostomus.
Centriscus.
Centriscus proper.
Amphisile.

ORDER II.—MALACOPTERYGII ABDOMINALES.

FAMILY I.—CYPRINIDÆ.

Cyprinus.
Cyprinus proper.
Barbus.
Gobio.
Tinca.
Cirrhinus.
Abramis.
Labeo.
Catastomus.
Leuciscus.
Chela.
Gonorhynchus.
Cobitis.
Anableps.
Pæcilia.
Lebias.
Fundulus.
Molinesia.
Cyprinodon.

FAMILY II.—ESOCIDÆ.

Esox.
Esox proper.
Galaxias.
Alepocephalus.
Microstoma.
Stomias.
Chauliodus.
Salanx.
Belone.
Scomberesox.
Hemiramphus.
Exocetus.
Mormyrus.

FAMILY III.—SILURIDÆ.

Silurus.
Silurus proper.
Schilbe.
Mystus.
Pimelodes.
Bagrus.
Pimelodes proper.
Synodontis.
Ageneiosus.
Doras.
Heterobranchus.
Macropteronotes.
Plotosus.
Callichthys.
Malapterurus.
Platystachus.
Loricaria.
Hypostomus.
Loricaria proper.

FAMILY IV.—SALMONIDÆ.

Salmo.
Salmo proper.
Osmerus.
Mallotus.
Thymallus.
Coregonus.
Argentina.
Characinus.
Curimata.
Anostomus.
Gasteropelecus.
Piabucus.
Serrasalmo.
Tetragonopterus.
Chalceus.
Myletes.
Hydrocyon.
Citharinus.
Saurus.
Scopelus.
Aulopus.
Sternoptyx.

FAMILY V.—CLUPIDÆ.

Clupea.
Clupea proper.
Alosa.
Chatoessus.
Odontognathus.
Pristigaster.
Notopterus.
Engraulis.
Thryssa.
Megalops.
Elops.
Butirinus.
Chirocentrus.
Hyodon.
Erythrinus.
Amia.
Sudis.
Osteoglossum.
Lepisosteus.
Polypterus.

spiny; and the jaws, the front of the vomer, and almost always the palatine bones, are furnished with teeth.

The species of this family are extremely numerous, especially in the tropical seas. Their flesh is in general wholesome, and of an agreeable flavour. By far the greater number have their ventral fins attached beneath the pectoral, and thus form a first division, named

THORACIC PERCIDÆ.[1]

A. *Seven branchial rays; two dorsal fins.*

a. *All the teeth small and crowded.*

GENUS PERCA, Cuv. Pre-opercle dentated; bony opercle terminated by two or three sharp points; tongue smooth. Sometimes the sub-orbital and humeral bones are slightly dentated.

The common perch (*Perca fluviatilis*, Linn.), Plate CCXCVIII. fig. 1, one of the most beautiful of the fresh-water fishes of Europe, is too familiarly known to require description. It inhabits both lakes and rivers, but shuns salt water.[2] As an article of food it is still in some estimation, although the character given of it in that respect by Ausonius is higher than accords with modern views. The female deposits her ova, united together by a viscid matter, in lengthened strings, a peculiarity noted by Aristotle. The number of these eggs sometimes amounts to nearly a million. The perch occurs over all Europe, and most of the northern districts of Asia. Pennant alludes to one said to have been taken in the Serpentine River, in Hyde Park, which weighed nine pounds. But even one half of that weight would be regarded as extraordinary in the present species.

The *Perca Italica* occurs in the south of Europe, and is distinguished by the want of the black bands so conspicuous in the common kind. Several other species are found in North America. *P. ciliata* is a native of Java; and *P. trutta* occurs in Cook's Strait, New Zealand.

GENUS LABRAX, Cuv. Distinguished from the preceding by scaly opercula terminating in two spines, and by the roughness of the tongue.

To this genus belongs the basse or sea-perch (*P. labrax*, Linn.; *Labrax lupus*, Cuv.), Plate CCXCVIII. fig. 2, a fish of a chaste and pleasing aspect, though destitute of the more strongly contrasted colours of the fresh-water species. Its upper parts are gray, with bluish reflections, which gradually shade away into a silvery whiteness on the under surface. The pectoral fins are slightly tinged with red. It occurs along the Dutch and British shores, but is

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ORDER III.—MALACOPTERYGII SUB-BRACHIATI.

FAMILY I.—GADIDÆ.

Gadus.
- Morrhua.
- Merlangus.
- Merluccius.
- Lota.
- Motella.
- Brosmius.
- Brotula.
- Phycis.
- Raniceps.

Macrourus.

FAMILY II.—PLEURONECTIDÆ.

Pleuronectes.
- Platessa.
- Hippoglossus.
- Rhombus.
- Solea.
- Monochirus.
- Achirus.
- Plagusia.

FAMILY III.—DISCOBOLI.

Lepadogaster.
- Lepadogaster proper.
- Gobiesox.

Cyclopterus.
- Lumpus.
- Liparis.

Echeneis.

ORDER IV.—MALACOPTERYGII APODES.

FAMILY I.—ANGUILLIFORMES.

Muræna.
- Anguilla.
  - Anguilla proper.
- Conger.
- Ophisurus.
- Muræna proper.
- Sphagebranchus.
- Monopterus.

Synbranchus.
- Alabes.

Saccopharynx.

Gymnotus.
- Gymnotus proper.
- Carapus.
- Sternarchus.

Gymnarchus.

Leptocephalus.

Ophidium.
- Ophidium proper.
- Fierasfer.

Ammodytes.

ORDER V.—LOPHOBRANCHII.

Syngnathus.
- Syngnathus proper.
- Hippocampus.
- Solenostomus.

Pegasus.

ORDER VI.—PLECTOGNATHI.

FAMILY I.—GYMNODONTES.

Diodon.

Tetrodon.

Orthagoriscus.

Triodon.

FAMILY II.—SCLERODERMI.

Balistes.
- Balistes proper.
- Monocanthus.
- Aluteres.
- Triacanthus.

Ostracion.

Second Great Series, called CHONDROPTERYGII, or CARTILAGINOUS FISHES.

ORDER I. (7th of the entire Class.)—STURIONES, or CHONDROPTERYGII WITH FREE BRANCHIÆ.

Acipenser.

Spatularia.

Chimæra.
- Chimæra proper.
- Callorhynchus.

ORDER II. (8th of the entire Class.)—CHONDROPTERYGII WITH FIXED BRANCHIÆ.

FAMILY I.—SELACHII.

Squalus.
- Scyllium.
- Squalus proper.
  - Carcharias.
  - Lamna.
  - Galeus.
  - Mustelus.
  - Notidanus.
  - Selache.
  - Cestracion.
  - Spinax.
  - Centrina.
  - Scymnus.
- Zygæna.
- Squatina.
- Pristis.

Raia.
- Rhinobatus.
- Rhina.
- Torpedo.
- Raia proper.
- Trygon.
- Anacanthus.
- Myliobatis.
- Rhinoptera.
- Cephaloptera.

FAMILY II.—SUCTORII.

Petromyzon.

Myxine.
- Heptatremus.
- Gastrobranchus.

Ammocætes.

[1] Almost all the species were included by Linnæus in his genus PERCA, but Cuvier has divided them, as shown above, according to the amount of the rays of the branchiæ, the number of the dorsal fins, and the nature of the teeth.

[2] Pallas, however, is said to have remarked, in a work, we believe, still unpublished (*Zoographia Russo-Asiatica*), that about spawning time both pike and perch are found in a gulf of the Caspian Sea, about thirty verstes from the mouth of the Terek.

much more abundant in the Mediterranean. It is a voracious fish, remarkable for the size of its stomach, and was known to the ancients under the appropriate name of *lupus*.

GENUS LATES, Cuv. Scarcely differs from Perca, except in having deep dentations, and even a small spine at the angle of the pre-opercle, and by stronger dentations also on the sub-orbital and humeral bones.

We shall here notice only the *L. Niloticus*, the largest and one of the finest-flavoured fishes of the celebrated Nile. It is altogether of a silvery tint, tinged on the upper parts and fins with olive brown. Individuals of a very great size are sometimes found in Upper Egypt, and, according to Paul Lucas, the species occasionally attains to the weight of 300 pounds. Other kinds occur in India, where they are highly esteemed as food.

GENUS CENTROPOMUS, Lacépède. Pre-opercle dentated; opercle obtuse, and unarmed.

C. *undecimalis*, Cuv. is a large and excellent fish, known along a great extent of the South American shores, where it is much used as an article of consumption, under the name of *brochet* or pike. In the form of its muzzle, and general shape, it somewhat resembles that fresh-water fish, and indeed it frequently ascends the great rivers to a considerable height. A kind of caviar is made of its row. It attains to the weight of twenty-five pounds.

GENUS GRAMMISTES, Cuv. Opercle and pre-opercle spined, but not dentated; dorsal fins approximate; scales small, as if sunk beneath the epidermis; anal fin without apparent spine.

Of this genus there seems to be only a single species, *G. orientalis*, a small fish, native to the Indian seas.

GENUS ASPRO, Cuv. Body elongated; dorsals not approximate; ventrals broad; teeth small and close (en velours); head depressed; muzzle reaching beyond the mouth, and terminating in a rounded point.

We are acquainted with only two species of this genus, both of which are known in the fresh waters of the continent of Europe. We have represented *A. vulgaris* (*Perca asper*, Linn.), on Plate CCXCVIII. fig. 3. It is a small fish, rarely exceeding half a foot in length, common in the Rhone, especially between Lyons and Vienne.

We shall here pass over some limited genera, of which the species are all foreign to Europe; such as HURO, which contains the black bass, or black perch, of the English inhabitants of the banks of the Huron; ETELIS, NIPHON, ENOPLOSUS, and DIPLOPRION. The species of the last two genera are remarkable as resembling Chætodons in their general form, rather than percoid fishes.

GENUS APOGON, Lacépède. Body short, and, in common with the opercles, furnished with large scales which are easily dislodged; dorsal fins very separate; a double dentated border on the pre-opercle.

The *Apogon rex Mullorum* of Cuvier (*Mullus imberbis*, Linn.) is a small Mediterranean species, of a red colour, with a black spot on each side of the tail. It measures about three inches in length. The foreign species seem chiefly confined to the Indian seas, at least they have not yet been observed in those of Africa or America. A few have been met with along the shores of New Holland, New Guinea, &c.

GENUS POMATOMUS, Risso. Resembles the preceding in the separation of its dorsals, and its deciduous scales; but the pre-opercle is simply striated, the opercle emarginate, and the eye enormously large.

The only known species is the *P. telescopium*, a fish of excessive rarity. According to Risso, it scarcely ever leaves the bottom of the deep sea. He is aware of only two specimens having been taken near Nice during a period of thirty years. It measures about twenty inches in length. The colours are brownish violet, with red and blue reflections, the fins being brownish black. Whether the prodigious dimensions of its eyes are in any way connected with the depth and consequent darkness of its abode, is a point which we have not at present any means to determine.

b. *Some long and pointed teeth mixed with the close-set kind.*

GENUS AMBASSIS, Commerson. Resembles Apogon in form; the pre-opercle has a double dentation towards the base, and the opercle terminates in a point; but the two dorsals are contiguous, and the anterior one is preceded by a spine.

A peculiarity in the intestinal canal, that is, the want of appendages to the pylorus, renders the present position of this genus in the system somewhat doubtful. The species are small fishes found in the fresh waters of India. One of them, *A. Commersonii*, Cuv. is abundant in a small lake in the island of Bourbon, where it is prepared as the Europeans do anchovies.

GENUS LUCIO-PERCA, Cuv. Margin of the pre-opercle with only a simple dentation, dorsal fins not approximate.

This genus receives its name from the supposed combination which certain of its species exhibit of the characters of the pike and perch,—that is, they possess the fins and banded markings of the latter, with the elongated head and body, and acute lengthened teeth, of the former. The best known species is the *L. sandra* of Cuvier (*Perca lucioperca* of Bloch), an excellent fish, found in the lakes and rivers of Germany and the east of Europe, but unknown in France, Italy, and England. It sometimes attains to the size of a large salmon. Its growth is remarkably rapid, and its flesh is said to be rich and agreeable. Great quantities, preserved by salt or smoke, are exported from Prussia and Silesia.

B. *Seven branchial rays; only one dorsal fin.*

This subdivision is divisible, like the preceding, according to the nature of the teeth, the spines and dentations of the opercles, and other characters.

a. *Teeth hooked or canine.*

GENUS SERRANUS, Cuv. Pre-opercle dentated, bony opercle terminated by one or more points.

This extensive genus has been recently partitioned into several minor groups. SERRANUS proper contains the *Perca scriba* of Linn.; so called on account of some peculiar markings in the cheeks, resembling written characters.[1] ANTHIUS is represented by *A. sacer* of Bloch, a beautiful fish of the Mediterranean, of a ruby-red colour, changing into gold and silver, with yellow bands upon the cheeks. The third ray of the dorsal fin is greatly elevated, and the ventrals are much prolonged. This fish appears to have been known to ancient writers, and was regarded as sacred by the divers for marine productions, from the fond belief that no dangerous species would approach its haunts. When an individual happen-

[1] The smooth Serranus (*S. cabrilla*, Cuv.; *Perca channus*, Couch) has been described as a British species. Mr Couch regards it as a common fish, well known to the Cornish fishermen. He mentions (*Magazine of Nat. Hist.* vol. v. p. 19) that it keeps in the neighbourhood of rocks not far from land; and adds, as a singular fact, that the spasm which seizes it when taken never passes off. Hence it is found long after death in a state of rigidity and contortion, with the fins preternaturally erect. Both Cuvier and Cavolini have described this and other species of the genus as actual hermaphrodites,—one portion of each lobe of roe consisting of true ova, the other having every appearance of a perfect milt.

ed unfortunately to be caught by the fisherman's hook, it was supposed that its companions immediately severed the line by means of their sharp spines. Merrus of Cuv. contains the *Perca gigas* of Gmelin, a species which sometimes attains to the weight of sixty pounds.[1] This subdivision of the genus Serranus contains a great amount of species. The only other which we shall here mention is that which we have shown in Plate CCXCVIII. fig. 4, under the name of *Serranus altivelis*, which is chiefly remarkable for the great size of the posterior portion of the dorsal fin. It occurs in the seas around Java.

Genus Plectropoma, Cuv. Differs from Serranus chiefly in the more or less numerous dentations of the inferior margin of the pre-opercle, being directed obliquely forward,—recalling in some measure the teeth of the rowel of a spur. All the species are foreign to Europe; and the same observation applies to the genus Diacope, the characters of which we shall not here detail.

Genus Mesoprion, Cuv. Agrees with Serranus in its teeth, fins, and dentated pre-opercle, but differs in its opercle being terminated by an obtuse angle, not spinous. The species are remarkable for the varied richness and lustre of their colours. They inhabit both the eastern and western seas, but occur chiefly in those of India, China, and Japan, concealing themselves in the hollows of rocks, and leaving their sombre haunts only during fine weather, to prey on the delicate Mollusca with which those waters swarm. Many of the species are large, and excellent as articles of food. *M. vivanus* attains the weight of forty pounds. We have figured, on Plate CCXCVIII. fig. 5, an American species of great beauty, described by Cuvier under the name of *M. uninotatus*. The back and upper portion of the head and cheeks are of rich steel blue, the lower part of the cheeks and sides of a fine rose colour, the abdomen silvery. The entire body is coursed by many bands of a golden hue, irregular and disconnected on the dorsal surface. The dorsal fin is rose-colour, with three yellow bands; the other fins are gamboge yellow. This species seldom much exceeds a foot in length.

b. *Teeth fine, and closely set.*

Genus Acerina, Cuv. Distinguished by cavities or depressions in the bones of the head, and by the opercle and pre-opercle having only small spines, without dentations.

We shall here name only the *Acerina vulgaris* (*Perca cernua*, Linn.), a British species, commonly called the ruffe, much esteemed for the delicacy of its flesh. Mr Yarrell informs us that it is common to almost all the canals and rivers of England, particularly the Thames, the Isis, and the Cam. Though said to be unknown in Spain, Italy, and Greece, it occurs pretty generally over the colder portion of the European continent, preferring slow, shaded streams, and a gravelly bottom.[2]

It is angled for with a small red worm, and being gregarious, six or eight dozen may sometimes be taken at a single stand.

Genus Rypticus, Cuv. Small spines on the opercles; scales likewise small, and concealed, like those of Grammistes, beneath a thick epidermis. The genus, however, is well distinguished from the latter by the single dorsal fin. The species have been named *Savonniers* by the French, in consequence of their soft and soapy surface, which feels as if it had been lubricated by some unctuous matter.

Genus Polyprion, Cuv. In addition to spines on the opercle, and dentations on the pre-opercle, the former is furnished with a rough bifurcated crest, and the bones of the head generally are marked by asperities.

P. *cernium* is an enormous fish, extremely common in the Mediterranean, but very indistinctly characterised or understood before the time of Cuvier and his able coadjutor M. Valenciennes. It attains the length of five or six feet, and sometimes weighs a hundred pounds. The flesh is white, tender, and well tasted. It is frequent, according to Risso, near Nice, where it delights in rocky bottoms, and is occasionally captured at the vast depth of three thousand feet.

Cuvier here places the singular genus Pentaceros, of which the sole species, bearing some resemblance in its general aspect to the *Ostracion auritus* of Shaw, was brought to Holland by M. Horstock. We shall here likewise merely name the genera Centropristis and Gristes of Cuvier, the former containing the *Black Harry* of the Americans, an excellent fish, common near New York,—the latter, the species called *growler* in the United States.

The ancient unrestricted genus Perca, as defined by Artedi and Linnæus, terminates in this place. But there remains a large assemblage of allied species referrible to various distinct genera, though still pertaining to the great family of Percidæ.

C. *With less than seven branchial rays.*

a. *With a single dorsal fin, and canine teeth mingled with the others.*

In this subdivision we place the genus Cirrhites alone. The species are from the Indian seas, and have only six branchial rays.

b. *With a single dorsal fin, and small close-set teeth.*

Here are classed the genera Chironemus, Centrarchus, and Pomotis. To the last belongs the *P. vulgaris*, Cuv. (*Labrus auritus*, Linn.), called pond-perch in New York. It is frequent in mill-dams and other tranquil waters, and is often angled for in America, both for pleasure and profit. According to Dr Richardson, it is called *sun-fish* around Lake Huron. See Plate CCXCVIII. fig. 6. Of the genus Priacanthus we shall merely observe, that the species are peculiar to the seas of hot climates. The genus Dules resembles *Centropristis* already described, except that it possesses only seven branchial rays. *D. rupestris* bears resemblance to a carp, and is found in the fresh waters of the islands of Bourbon and the Mauritius, where it is highly esteemed for the excellence of its flavour. We have figured one of the most remarkable of the genus (Plate CCXCVIII. fig. 7), named *Dules auriga* by Cuvier, on account of the long whip-like form assumed by the third spine of the dorsal fin. It was brought from Brazil by M. Delalande.

We shall conclude this subdivision by a brief notice of the genera Therapon, Datnia, Pelates, and Helotes. It has been observed that these constitute a group, formed, as it were, to make naturalists despair, by showing how nature laughs at what we deem characteristic combinations. The genera above named, possessing a multitude of mutual relations, as well interior as external, sufficient to forbid their distant separation, and bearing a great resemblance to the entire percoid family, at the same time combine species furnished with palatine teeth,

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[1] It is synonymous with *Perca robusta* of Mr Couch, made known by that gentleman as a British species, from a single specimen taken with a line. (See *Magazine of Natural History*, vol. v. p. 21.)

[2] *History of British Fishes*, p. 18.

along with other species which seem to be constantly deprived of these organs. They also possess close-set teeth in the jaws, and dentations on the sub-orbital, the pre-opercle, and not unfrequently on the shoulder bone; none has more than six branchial rays; no scales are visible on the cranium, muzzle, or maxillæ; the dorsal spines are folded back into a groove of the back; and the swimming bladder is constantly divided by a restriction into two distinct sacks, as in *Cyprinus*, *Choracinus*, and *Myripristis*,—a character somewhat remarkable in any group of the acanthopterygian order.

c. *With two dorsal fins.*[1]

Genus Trichodon, Steller. Pre-opercle with several strong spines; opercle terminating in a flattened point; no scales; mouth almost vertically cleft.

Of this genus only one species has been yet discovered, the *T. Stelleri* of Cuv. It was found by the unfortunate Steller near Cape Cronock, and especially at the island of Unalaschka. It inhabits sandy shores, in which it conceals itself on the ebbing of the tide, and is there collected by the natives with their hands. The females deposit their eggs in little hollows in the sand, and offer, it is said, an exception to the ordinary instinct of fishes, in attending to their young ones after they are hatched.

Genus Sillago, Cuv. Head somewhat drawn to a point; mouth small; small crowded teeth on the jaws, and before the vomer; opercle terminating in a small spine; six branchial rays; dorsal fins contiguous;—the spines of the first slender, of the second long and low.

The species occur in the Indian Seas, and are held in high esteem for the delicate flavour and brightness of their flesh. The most noted species is the *peche madame* of Pondicherry (*S. domina*), of a brownish colour, and remarkable for the first ray of the dorsal fin being elongated to a filament as long as the body. Another species, called *Soring* by Russell (the *Sciæna malabarica* of Bloch), measures about a foot in length, and is of a fulvous colour. It is regarded as one of the best fishes in India.

D. *With more than seven branchial rays.*

The genera of this group, besides possessing eight branchial rays, are distinguished by this further peculiarity, otherwise unexampled among the acanthopterygian tribes, that they possess, besides the spine, seven soft rays, or even more, to each of the ventral fins. Many of the species are remarkable for their beauty.

Genus Holocentrum, Artedi. Scales brilliant and dentated; opercle dentated and spinous; pre-opercle not only dentated, but furnished at its angle with a strong spine directed backwards.

The species of this genus are widely distributed, occurring in the warmer portions of both the Pacific and Atlantic Oceans. Few species are more remarkable, either for the magnificence of their integuments, or the strength of their spines. The lustre of their scales equals that of a mirror, and is rendered still more brilliant by bands of red and spots of brown variously distributed. They bear a close resemblance to each other. That which we have selected as an illustration (Plate CCXCVIII. fig. 8) is the *H. hastatum* of Cuvier, which exists in the Royal Museum of Paris. Its native country is unknown, although it is presumed to have been brought from the African coast, and seems identical with specimens more recently collected by MM. Quoy and Gaymard at the Cape de Verd Islands.

Genus Myripristis, Cuv. Resembles the preceding in splendour, form, and scales; but the pre-opercle has a double dentated margin, and wants the spine at the angle.

This genus is remarkable for its swimming bladder being divided into two portions, of which the anterior is bilobed and attached to the cranium in two places, where it is merely covered by a membrane, and which correspond to the cavities of the ears.

The genera Beryx and Trachichtys are nearly allied to the preceding. The latter was originally characterised, and somewhat vaguely, by Dr Shaw, from a specimen received from the New Holland seas.

All the percoid fishes to which we have hitherto alluded are characterised by having their ventral fins inserted beneath the pectorals. But in several genera these important organs are otherwise placed. Thus, in the ensuing group, their position is in advance of the pectorals, that is, upon the throat. They are hence called

Jugular Percidæ.

Genus Trachinus, Linn. Head compressed; eyes approximate; mouth oblique; first dorsal very short, the second very long; pectorals large; opercle furnished with a strong spine.

Several of the species occur in the European seas, and two species, known in our own country as the greater and lesser weevers (*T. major* and *draco*), occur occasionally on the English coasts. They remain concealed in the sand, and the wounds inflicted by their spines are not only painful, but dangerous.

"That the greater weever," observes Mr Yarrell, "prefers deep water, that it lives constantly near the bottom, that it is tenacious of life when caught, and that its flesh is excellent, are four points that have been already noticed; but this subject, in reference to fishes generally, may be farther illustrated. It may be considered as a law, that those fish that swim near the surface of the water have a high standard of respiration, a low degree of muscular irritability, great necessity for oxygen, die soon, almost immediately, when taken out of water, and have flesh prone to rapid decomposition. On the contrary, those fish that live near the bottom of the water have a low standard of respiration, a high degree of muscular irritability, and less necessity for oxygen; they sustain life long after they are taken out of the water, and their flesh remains good for several days. The carp, the tench, the various flat fish, and the eel, are seen gaping and writhing on the stalls of the fishmongers for hours in succession; but no one sees any symptom of motion in the mackerel, the salmon, the trout, or the herring, unless present at the capture. These four last named, and many others of the same habits, to be eaten in the greatest perfection, should be prepared for table the same day they are caught;[2] but the turbot, delicate as it is, may be kept till the second day with advantage, and even longer without injury; and fishmongers generally are well aware of the circumstance, that fish from deep water have the muscle more dense in structure,—in their language, more firm to the touch,—that they are

[1] In the indication of this group in the *Règne Animal*, t. ii. p. 149, there seems to be a typographical error where the words "à moins des *six* rayons branchiaux" are used, instead of *sept*. The mistake has been copied as a matter of course into all the English and American translations.

[2] The chub swims near the top of the water, and is caught with a fly, a moth, or a grasshopper, upon the surface; and Isaac Walton says, "But take this rule with you—that a chub newly taken and newly dressed is so much better than a chub of a day's keeping after he is dead, that I can compare him to nothing so fitly as to cherries newly gathered from a tree, and others that have been bruised and lain a day or two in water."

of finer flavour, and will keep longer, than fish drawn from shallow water.

"The law referred to has its origin in the principles of organization; and though it would be difficult for the anatomist to demonstrate those deviations in structure between the trout and the tench which give rise to these distinctions and their effects, it is only necessary to make the point of comparison wider to be assured of the fact.

"Between a fish with a true bony skeleton, the highest in organization among fishes, and the lamprey, the lowest, the differences are most obvious. If we for a moment consider the lamprey, which is the lowest in organization of the vertebrated animals, with only a rudimentary vertebral column, as the supposed centre of zoological structure, and look from thence up and down the scale of organization, we on the extreme on one side arrive at man, to whom division of his substance would be destruction; but on the other we come to the polype, the division of which gives rise to new animals, each possessing attributes, not only equal to each other, but equal also to the animal of which they previously formed but a small part."[1] The species represented in our accompanying illustration (see Plate CCXCVIII. fig. 9) is *T. radiatus*, well known in the Mediterranean.

The Trachini of exotic regions, if such exist, are unknown. They are in some measure represented there by the genus Percis of Bloch and Schneider, which is found in the Indian, African, and New Holland seas.

The genus Pinguipes, of a heavy form, is distinguished by its strong conical teeth; its fleshy lips, and teeth upon the palate; and by its thick ventrals. The only known species is from Brazil. The genus Percophis, on the contrary, is much elongated in its shape (combining, as it were, that of the perch and serpent,—from whence the name); some of the teeth are long and pointed, and the extremity of the lower jaw projects. The sole species is a rare and remarkable fish from Rio Janeiro, discovered by the French naturalists attached to Freycinet's expedition.

Genus Uranoscopus, Linn. Eyes placed on the upper surface of a nearly cubical-shaped head; mouth vertically cleft; pre-opercle crenate towards its base; a strong spine at each shoulder; gills with only six rays.

In the interior of the mouth of this remarkable genus, and in front of the tongue, there is a long and narrow shred, which they can exsert at pleasure, and which it is said they use while lying concealed in the mud, to attract their prey, consisting of the smaller fishes. Another singularity in their structure consists in the immense size of the gall-bladder, a fact well known to ancient observers. In some of the species the first dorsal, which is small and spinous, is separated from the second, which is soft and long. Such is *U. scaber*, a Mediterranean species, not unfrequently used as food, although of a most ugly and repelling aspect. In others the dorsal is single, and its spinous and softer parts continuous. Such is *U. inermis*, the species represented in Plate CCXCVIII. fig. 10, which attains to the length of a couple of feet, and is native to the coast of Coromandel. It dwells in the sand, and the Indian fishers allege, what is no doubt a gross exaggeration, that it sometimes penetrates to a depth of twenty feet.

In the third principal division of the percoid family the ventral fins are inserted behind the pectorals. They are hence named

Abdominal Percidæ.

Genus Polynemus, Linn. Several of the inferior rays of the pectorals free, and forming so many filaments; ventrals not greatly posterior to the pectorals; pelvis still suspended to the bones of the shoulder.

The species are allied to the Percidæ in general by the close set teeth upon their jaws, vomer, and palate; but they possess the arched or convex snout, and the scaly vertical fins, which distinguish so many of the Sciænidæ. Their two dorsals are distant; their pre-opercle dentated, and their mouths greatly cleft. They appear to inhabit the seas of all warm countries. *P. longifilis* of Cuv. (*P. paradiseus* and *quinquinarius*, Linn.) is the noted *mango-fish* of India, so called from its fine yellow colour. According to Russel and Hamilton Buchanan, it is the most delicious of all the species eaten in Bengal. It is fished for all the year round, at the mouths of rivers, where the waters are saline. It ascends to some distance about spawning time in spring, but not beyond the influence of the tide. When in prime condition, the mango-fish, though only a few inches long, sells so high as a rupee. The eggs are also much esteemed. The colours of this species, like those of other fishes, seem to vary greatly, probably in relation to the condition of individuals, or the season of the year. M. Dussumier describes it as of a citron yellow, with the fins and filaments of a beautiful orange. Buchanan states that the greater number are silvery, with reflections of gold and purple, and a greenish tint upon the back; the fins being then yellow, and the upper parts spotted with black. The same author names the silvery mango-fish *P. risua*, and the yellow ones *P. aureus*; but he hesitates to make them distinct species, and rather opines that the fine colour is the result of season, and that it continues only during spawning time. This view of the subject is well confirmed by the fact, that the high-coloured specimens sent to Europe by M. Dussumier were full either of roe or milt, and is moreover in exact conformity with the observations of all practical anglers and Ichthyologists in relation to the species of our own country. We here figure (Plate CCXCVIII. fig. 11) a recently-discovered species, received by Baron Cuvier from Senegal. It is named *P. quadrifilis*, having only four free rays on the pectoral fins.

In the ensuing genera of the abdominal Percidæ, the ventrals are placed farther back, and the pelvis no longer adheres to the bones of the shoulder.

Genus Sphyræna, Bloch and Sch. Form elongated; two distant dorsals; head oblong, with the lower jaw forming a projecting point beyond the upper one; a portion of the teeth large, pointed, and cutting; opercle without spines; pre-opercle without dentations; seven branchial rays; numerous appendages to the pylorus.

These fish were formerly classed with the pikes; and the Italians still name them *Lucii marini*, on account of their strong and pointed teeth. The Mediterranean species (*S. vulgaris*, Cuv.; *Esox sphyræna*, Linn.) attains to the length of three feet. *S. picuda*, from the coast of Brazil, is extremely similar. This fish, though used as an article of food, is occasionally poisonous. M. Poey alleges that the malady produced by eating it is sometimes mortal; but he adds that it is easy to distinguish the dangerous individuals beforehand, by a peculiar blackness at the base of their teeth. Another species (*S. barracuda*, Cuv.; *Esox barracud*, Shaw), which likewise occurs along the Brazilian shores, and among the Antilles, is said to be extremely formidable, on account of its ferocious habits. It is among the number of those marine monsters of which Rochefort speaks in his *Histoire des Antilles*, as greedy of human flesh. He states it to attain the length of seven or eight feet, and that it darts with fury upon any man whom it perceives in the water.

[1] *British Fishes*, p. 22.

The wounds of its teeth are said to be mortal. Dutertre attributes to it the same great size and malign qualities, and regards it as more dangerous than the fiercest shark. Neither noise, nor any kind of threatening movement, has the slightest effect in producing intimidation; on the contrary, such signs of dislike only excite it to a greater readiness to seize upon its victim. It must be a most disagreeable creature.

Genus Mullus, Linn. Surface of the body and opercles covered by large deciduous scales; pre-opercle without dentations; mouth small, or but slightly cleft, and feebly toothed; dorsal fins distant from each other; a pair of barbles or appendages depending from the symphysis of the lower jaw.

This genus, although allied to the Percidæ by several anatomical and external details, is yet characterised by so many peculiarities of organization, that it might almost be regarded as forming of itself a special family. Cuvier, however, has placed it *à la suite* of the Percidæ, and we shall therefore follow that great authority in this as in the other portions of our ichthyological system. The genus Mullus is now divided into two.

1. Mullus proper. Branchiæ with three rays; opercle spineless; no teeth to the upper jaw; two large plates of small teeth *en pavé* on the vomer; no swimming bladder.

To this sub-genus belongs the famous red mullet (*M. barbatus*), Plate CCXCVIII. fig. 12, which, by reason both of its great personal beauty, and the exquisite flavour of its flesh, has for so many ages ministered to the degenerate and heartless luxury of man. It is very frequent in the Mediterranean, and also occurs occasionally along the outer and more northern coasts of Europe. It is brought occasionally to the London markets during the mackerel season; but it is doubtful whether Müller is not in error in assigning to it so northern a locality as Denmark. "The great and rich among the Romans were in the habit, according to Varro, of preserving the red mullet in artificial waters, as one of the most convincing proofs of their individual wealth. Cicero has ridiculed the senseless ostentation with which they exhibited fine specimens of this fish, domiciliated in their own ponds; but Seneca and Pliny have rendered their countrymen odious in the eyes of posterity, and of other nations, by relating the cruelty with which, in their disgusting orgies, they revelled over the dying mullet, while the bright red colour of its healthy state passed through various shades of purple, violet, blue, and white, as life gradually receded, till the convulsions of death put an end to the *pleasing* spectacle. They had these devoted fish enclosed in water in vessels with sides of crystal, over a slow fire, on their tables, and derived a fiend-like pleasure from the lingering sufferings of their victims as the increasing heat of the water gradually destroyed them, before the final operation of boiling had rendered them fit to gratify the refined taste of civilization. One cannot indeed read these revolting histories of old time without a blush at certain modern practices far too analogous with them: the sense of taste may, in the cases alluded to, be alone consulted; but the difference is nothing to the suffering animal, whether its torments gratify one or more of the evil passions of its tormentors. The skinning of eels, and the boiling of live crustacea, would be as disgusting as the gradual boiling of a mullet, did not, in this as in many other cases, the practice of evil destroy the feeling of its iniquity. So extravagant was the folly of the Romans with regard to this fish, that they often gave for them immense prices. Martial mentions one of four pounds weight, which had cost 1300 sesterces; and it is said that the Emperor Tiberius sold one weighing nearly five pounds for 4000 sesterces. Asinius Celer, one of the consuls, is reported by Pliny to have paid 8000; and, according to Suetonius, 30,000 sesterces had been given for three mullets."[1]

The surmulet, or striped mullet (*M. Surmuletus*, Linn.), is larger than the preceding, and measures about a foot in length. It is much more common as a British species than the preceding, being of frequent occurrence along the extended line of our southern coast, from Cornwall to Sussex; but becoming rarer as we proceed from thence northward by the eastern coast. It has been regarded as migratory, yet it appears in the shops of the London fish-mongers throughout the year, though in much greater plenty during May and June, at which time their colours are most vivid, and the fish, as food, is in the best condition. The striped red mullet spawns in spring, and the young are five inches long by the end of October.[2] The species is much more extensively distributed than the red mullet, and is not confined, as Baron Cuvier seems to suppose, to European coasts. It occurs not far to the south of New York, and has been found in much greater numbers along the southernmost coasts of South America.[3] It has been supposed that to this species the larger specimens of mullet mentioned by the ancients are referrible. Pliny indeed states expressly that the large mullets were found especially in the Northern and Western Oceans.

2. Upeneus, Cuv. Branchiæ with four rays; teeth on both jaws, but frequently none on the palate; opercle with a small spine; a swimming bladder.

The species of this sub-genus are native to the seas of India and America. That which we have selected for illustration (Plate CCXCVIII. fig. 13) is the *H. Vlamingii* of Cuvier. It was sent to Paris by MM. Quoy and Gaymard, and when opened its stomach was found filled with small crustacea.

We here terminate the family of Percidæ, or perch-like fishes, and proceed to

FAMILY II.—BUCCÆ LORICATÆ, or MAILED CHEEKS.

There are a certain set of fishes which, in the totality of their structure, certainly approach the preceding family of the perches; but on which the singular aspect of their variously-armed heads bestows so peculiar a physiognomy, that they have always been classed together in special genera. As examples, we may mention the gurnards, father-lashers, and river bull-heads, belonging to *Trigla* and *Cottus*. The common character of all these fishes consists in the sub-orbital bone being more or less extended over the cheek, and articulating behind with the pre-opercle. The genus *Uranoscopus* alone of the preceding family exhibits some affinity to this form of structure; but still in that case, the sub-orbital, though very broad, is connected posteriorly, not with the opercle, but with the temporal bones. It is then from this peculiar extension and attachment of one or both of the sub-orbitals that the family of the *mailed cheeks* derives its name.

In the Linnæan system these fishes formed three genera, *Trigla*, *Cottus*, and *Scorpæna*, groups which have been considerably subdivided by Cuvier, who has more-

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[1] Griffith's *Animal Kingdom*, vol. x. p. 277.

[2] Yarrell's *British Fishes*, p. 27.

[3] Griffith's *Animal Kingdom*, vol. x. p. 278.

over added to them a certain portion of the genus *Gasterosteus*, or stickle-back tribe.

Genus Trigla, Linn. Here the family character is strongly marked. An enormous sub-orbital covers the entire cheek, and even articulates by means of an immovable suture with the pre-opercle, which in this way possesses no separate movement; the sides of the head are nearly vertical, producing a form approaching that of a cube or of a parallelopiped, and the bones are hard and granulated; the back bears two distinct dorsals, and beneath the pectorals are three free rays; in the interior we find about a dozen cæca, and a broad bilobed swimming bladder.

This extensive genus has been subdivided by modern writers.

Trigla proper contains the *gurnards* commonly so called. They have small close-set teeth on the maxillæ, and before the vomer; and their pectoral fins, though large, are incompetent to sustain them through the air. *T. cuculus*, Linn. (*T. pini* of Bloch), our red gurnard, is a voracious species, common in the European seas. *T. lyra*, named the piper, is another British species remarkable for the hissing sound which it produces when caught, by expelling air through its gills. It is a beautiful fish, of a bright red above, and silvery white below. *T. cuculus* of Bloch (*T. Blochii*, Yarrell) is another red gurnard, distinguishable by a black spot on the first dorsal fin. *T. lucerna* is a Mediterranean species, so named because it shines in the dark. *T. hirundo* is a British species, known as the sapphirine gurnard. Its pectoral fins are rich green and blue. The only other species we shall mention is the grey gurnard (*T. gurnardus*), Plate CCXCVIII. fig. 1. Its muzzle is bifurcated, with three spines on each side. It is easily taken with a hook, and is common in the British seas.

Prionites of Lacépède contains species analogous to those last named, but with pectorals so long as occasionally to sustain them in the air. Their precise character, however, consists in their having a band of small close-set teeth on each palatine.

Peristedion of Lac. is separated from Trigla proper, with still more correctness. The whole body is as it were cuirassed over by great hexagonal scales, forming longitudinal ridges; the muzzle is divided into two points, and bears branched barbles beneath; the mouth has no teeth. The only well-known species is the *T. cataphracta*, Linn. a Mediterranean fish, called *Malarmat* both at Marseilles and Genoa, probably by an antiphrase, as it is one of the most redoubtably armed of all the fishes of the European seas.

Dactylopterus of Lac., yet further removed from *Trigla*, contains certain (though not the whole) of those species known under the famous name of flying fishes.[1] Their sub-pectoral rays are much more numerous and extended, and instead of being free, as in the preceding groups, they are united by a membrane so as to form a supernumerary fin, longer than the fish itself, and capable of supporting it in the air.

The common Dactylopterus, or flying fish of the Mediterranean (*Trigla volitans*, Linn.), is a species too remarkable for its functions, so opposite to those of its class in general, not to have attracted from an early period the attention of mankind. It is extremely common in the Mediterranean, and has been mentioned by all the authors who have treated of the fishes of that inland sea. The ardour with which it is pursued by the dolphins and bonitos, the sudden effort which it makes to escape these predaceous creatures by vaulting into the air, the new and probably unthought of dangers which there await it from gulls and other aquatic birds, render it an object of the highest interest to the unaccustomed landsman, somewhat wearied with the monotony of a sailor's life. "It is by the extension of the pectoral rays and membrane that the fish is enabled to raise itself from its proper element to the regions of the air, though this is by no means a continual flight, for the utmost it can do is to describe an arch over the surface of the water extending to a distance of about 120 feet, and sufficiently elevated for the fish sometimes to fall on the deck of a large vessel. This power of flight or momentary suspension would be much greater if the pectoral membrane could preserve its humidity longer: this is soon evaporated in the heat of the tropics; and the membrane, as it becomes dry, loses its buoyant power, and the fish falls. They are sometimes so numerous as to afford much pleasure to the spectator by their repeated flights; and at particular times, especially on the approach of rough weather, in the night, numbers of them may be seen, by the phosphoric light they emit, marking their arched passages in apparent streams of fire.[2]"

It is singular that the species to which we now allude (*D. volitans*), though so frequent in the Mediterranean, should be almost entirely unknown along the oceanic coasts of Europe. Still more singular is it, in relation to that exclusion, that it should at the same time be found across the Atlantic, and spreading not only along all the central and southern shores of the New World, but extending even as far north as the chilly waters of Newfoundland. The great Gulf Stream may however prove influential in the northern distribution of many western species.

We shall conclude this notice by observing, that the fish in question measures about a foot in length; it is brown above, reddish below, with blackish fins, variously spotted with blue. Its most formidable weapon of offence consists of the long and pointed spine of the opercle, which it can raise and render almost perpendicular to its body. With this organ it is easy to conceive that it may produce serious, or even dangerous wounds; and we therefore wonder the less that a poet like Oppian should have declared them mortal.

There seems to be only one other clearly ascertained species of the genus *Dactylopterus*. It is the *D. orientalis* of Cuvier, and occurs in the Indian seas.

Genus Cottus, Linn. Head broad and depressed, mailed, and variously armed by spines or tubercles; two dorsal fins; teeth in front of the vomer, but none on the palatines; six rays to the branchiæ, and only three or four to the ventral fins. The inferior rays of the pectorals, as in the weevers (genus *Trachinus*), are not branched; the cæcal appendages are less numerous than in *Trigla*, and the swimming bladder is wanting.

The fresh-water species of this genus have the head almost smooth, and only a single spine to the pre-opercle. Their first dorsal is very low. The most common is the river bull-head (*Cottus gobio*, Linn.), sometimes called the miller's thumb. It is a small dark-coloured fish, four or five inches in length, and frequent in most of the streams of Europe and the north of Asia. It usually lies concealed beneath stones, from whence it darts with great rapidity upon its prey. It is said to be extremely prolific; and the female, when with spawn, becomes so greatly enlarged, that her ovaries protrude like mammæ. The bull-head, like the salmon, has a reddish hue when boiled. It affords a good and wholesome food, much sought after by the mountain tribes of several countries; yet Pallas as-

[1] Others, for example, belong to *Exocœtus*, one of the genera of *Malacopterygii abdominales*, to be afterwards described.
[2] Griffith's *Animal Kingdom*, vol. x. p. 280.

sures us that in Russia no one will taste it, although the common people hang it around their necks as an amulet, under the impression that it acts as a preservative against attacks of tertian fever. We have represented in this work (Plate CCXCVIII. fig. 2) a salt-water species, *C. scorpius*, commonly called the *father-lasher*, and frequent around our rocky coasts. Under the English name of father-lasher, two species, however, seem to have been confounded.[1] There are many other species of the genus, one of which is extremely common in all the bays and gulfs of Greenland.

Under the generic name of ASPIDOPHORUS, several Cotti have been separated from the parent group. Their bodies are cuirassed by angular plates, and the teeth are wanting on the vomer. Such is a small fish common on our shores, and of which the membrane of the gills is garnished with fleshy filaments. It is the *C. cataphractus* of Linn., our common *Pogge*, or armed bull-head. See Plate CCXCIX. fig. 3.

We may here name three genera as intermediate between *Cottus* and *Scorpæna*, viz. HEMITRIPTERUS (ibid. fig. 4), HEMILEPIDOTUS, and PLATYCEPHALUS. We cannot enter into any details regarding them.

GENUS SCORPÆNA, Linn. Head, as in Cottus, mailed and jagged, but compressed laterally; body covered with scales; seven rays to the branchiæ; a single dorsal fin.

These are small fishes of a repulsive aspect, to be almost inferred from the vulgar names bestowed upon them in most countries, such as scorpion, toad, sea-devil, &c. The species represented on the above Plate, fig. 5, was received from the Isle of France. Many others occur in the Indian seas, as well as in those of more northern countries.

The genus SEBASTES of Cuv. possesses most of the characters of *Scorpæna*, although the head is less jagged and scaly. The species are widely dispersed through both the northern and southern seas. We have selected as an illustration (Plate CCXCIX. fig. 6) *S. variabilis*, which attains to the length of two feet, and occurs in great abundance in the seas about Kamtschatka and the Aleutian Isles, where it is used as food. To this genus belongs another northern species (*S. norvegicus*, Cuv.; the *sea-perch* of Pennant), occasionally found along the British shores, and known to the Shetlanders under the name of *Bergylt*, or *Norway haddock*.[2]

The genus PTEROIS of Cuv. contains the *Scorpæna volitans* of Gmelin and other authors, remarkable for its enormous pectoral fins, which resemble those of the flying fish, except that they are feebler, and, from being so deeply notched, incapable of aiding the fish in leaving its native element. Mr Bennet was assured by the fishermen of Ceylon, where the species is very common, that they had never seen it fly.

The genus APISTUS, Cuv., resembles *Scorpæna* in its palatine teeth and dorsal fin; but the few rays of the pectorals are all branched. The distinguishing character, however, consists in the strong spine of the sub-orbitals, which on being projected from the cheek becomes a dangerous weapon; the more so, as in a state of repose it is scarcely perceptible. In fact, their generic name is derived from ἀπιστος, *perfidious*. M. Ehrenberg has made us acquainted with a species from the Red Sea, which greatly resembles the Indian *Woorah-minoo* described by Russel. It measures about four inches in length, and is of a reddish colour on the back, and whitish on the sides and abdomen. This Apistus flies like a *Dactylopterus*. Ehrenberg observed it in the vicinity of Tor; and whenever the sea was agitated, several fell into his vessel. As it is the only flying fish of the Red Sea, and is extremely abundant along those desert coasts over which the Israelites so long wandered, he has conjectured that the food mentioned in Exodus, ch. xvi. ver. 13, and by us translated *quails*, was in reality the fish in question. It is named by the Arabs *Gherad el bahr*, a term which we understand to signify *sea locust*. The genus is rather numerous. We have figured (Plate CCXCIX. fig. 7) *Ap. marmoratus*, a species transmitted by Peron from Timor. It surpasses the others in size, as well as in the lustre and precision of its marbled markings.

GENUS AGRIOPUS. No sub-orbital spine; dorsal still higher than in the preceding genus, reaching as far forward as between the eyes; the nape of the neck elevated; muzzle narrowed; mouth small and slightly toothed; body without scales.

The fish called sea-horse (*see paard*) by the Dutch colonists at the Cape, and used by them as food, belongs to this genus. It is the *A. torvus* of Cuvier.

GENUS PELOR, Cuv. Dorsal undivided, and teeth on the palate, like Scorpæna; body without scales; two free rays beneath the pectorals; anterior portion of the head appearing crushed; eyes approximate; dorsal spines very high, and almost free; sub-orbital spine wanting.

The fantastic shape and almost monstrous aspect of these fishes are alone sufficient to distinguish them from every other genus. It is scarcely possible by words alone to convey an idea of their extraordinary forms. They inhabit the Indian seas, and one of the most remarkable is *P. filamentorum*, a species from the Isle of France, discovered during Duperrey's expedition. It may be inferred to feed upon crustacea, as the remains of squillæ were found within its stomach.

The genus SYNANCEIA of Bloch and Schneider is quite as hideous as that of *Pelor*, and indeed surpasses all the Scorpænæ in ugliness. Their heads are rough, tuberculated, but not compressed, and frequently enveloped in a loose and fungous skin; their pectoral rays are all branched, their dorsals entire; they have no teeth either on the vomer or palatines.

S. horrida, as the title implies, exhibits by no means an inviting aspect. It is named *Ikan-swangi*, or sorcerer fish, by the Malays. *S. brachio* of Cuv. is the species called *fi-fi*, or *hideous*, by the Negroes of the Isle of France, who hold it in great abhorrence. In fact, nothing can be conceived more frightful. At first sight, no one would consider it a fish, but rather as a mass or unformed lump of corrupted jelly. "Totum corpus," says Commerson, "muco squalidum et quasi ulcerosum." Its head and members seem enveloped in a sack of thick, soft, spongy skin, warty and wrinkled like that of a leper, and irregularly blotted over with various tints of brown and grey. Sometimes it appears entirely black; but it is always gluey and disgusting to the touch. The little eyes are scarcely discernible in the large cavernous head. This species is said to possess great tenacity of life, and survives for a long time out of the water. The skin, in fact, forms a little ring like that of *Pelor*, in the upper part of the gills, above the point of the opercle, through which the fish can respire at pleasure, leaving the remainder of the cover closed, and the branchiæ consequently unexposed to desiccation. The inhabitants of the Isle of France regard it rather as a reptile than a fish; and they fear what they call its sting (that is, the wound inflicted by its spines) more than that of snakes or scorpions.

GENUS MONOCENTRIS, Bloch. Body short, thick, and

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[1] See *Hist. Nat. des Poissons*, t. iv. pp. 160-165; and Yarrell's *British Fishes*, pp. 60-63.
[2] Fleming's *British Animals*, p. 212.

completely mailed with enormous angular scales, rough and carinated; dorsal fin represented by four or five thick spines; each ventral consisting of a single enormous spine, in the angle of which some small soft rays lie concealed; head large and mailed; front gibbous; mouth large; small and close-set teeth in the jaws and palatines, but none upon the vomer; eight branchial rays.

Of this remarkable genus there is only a single species known, a small fish of a silvery whiteness, measuring about six inches in length. It inhabits the seas of Japan. See Plate CCXCIX. fig. 8.

Genus Gasterosteus, Cuv. Cheeks mailed, but the head neither spined nor tuberculated, as in the preceding genera. The special characters consist in the freedom of the dorsal spines, which do not form a fin, and in the pelvis being united to larger humerals than usual, thus furnishing the abdomen with a kind of bony cuirass. The ventrals, placed posterior to the pectorals, are reduced almost to a single spine. There are only three branchial rays.

The species are small fishes familiarly known under the name of Stickle-backs (Scotice, *Benticles*), extremely common in all the fresh waters of Europe. Gesner indeed asserted that they did not occur in Switzerland; but the contrary has been long since ascertained. Our most common species is *G. aculeatus*, Linn. (Plate CCXCIX. fig. 9), under which name, however, it is supposed that more than a single kind has been confounded. It is an active and greedy little fish, extremely destructive of the fry of other species, and consequently injurious in ponds where these are sought to be preserved. Mr Henry Baker informs us that it will spring not less than a foot perpendicularly out of the water, and to a much greater distance in an oblique direction, when it desires to overcome any opposing obstacle. "It is scarcely to be conceived," he adds, "what damage these little fish do, and how greatly detrimental they are to the increase of all the fish in general among which they live; for it is with the utmost industry, sagacity, and greediness that they seek out and destroy all the young fry that come in their way, which are pursued with the utmost eagerness, and swallowed down without distinction, provided they are not too large; and in proof of this, I must assert that a bannstickle which I kept for some time, did, on the 4th of May, devour, in five hours' time, seventy-four young dace, which were about a quarter of an inch long, and of the thickness of a horse-hair. Two days after it swallowed sixty-two; and would, I am persuaded, have eat as many every day, could I have procured them for it." The stickle-back sometimes swarms in prodigious numbers. Pennant states, that at Spalding, in Lincolnshire, there are once in seven years amazing shoals, which appear in the Welland, coming up the river in the form of a vast column. This concourse is supposed to arise from the multitudes which have been washed out of the fens by the floods of several years, and which collect in deep holes, till, overcharged with numbers, they are obliged to attempt a change of place. The quantity may perhaps be conceived from the fact, that a man employed in collecting them gained for a considerable time four shillings a day by selling them at the rate of a halfpenny a bushel. *G. pungitivus*, commonly called the smaller or ten-spined stickle-back, is the least of all our fresh-water fishes. In common, however, with a more truly marine species (*G. spinochia*, Linn., which forms a sub-genus), it is also found in the sea.[1]

We shall here conclude our exposition of the family with mailed cheeks.

FAMILY III.—SCIÆNIDÆ.

This family is closely related to the Percidæ, and exhibits almost all the same combinations of external characters, especially the dentations of the pre-opercle, and the opercular spines; but the Sciænidæ have never any teeth either on the vomer or palatines; the bones of the face and cranium are generally cavernous, and the muzzle more or less gibbous; a form rarely observed among the Percidæ. The vertical fins are frequently somewhat scaly.

Even in its interior organization our present family bears a considerable resemblance to the perches; but there are greater variations, and especially a more complicated structure of the swimming bladder. In several species that organ is furnished with a multitude of branched appendages (See Plate CCXCVII. figs. 6, 7, 8); and although we cannot trace in it any connection with the exterior, yet when we consider that many of the Sciænidæ are more remarkable even than the gurnards for the production of extraordinary sounds, it is difficult to believe that the peculiar structure of the swimming bladder is not in some way connected with their utterance. The Sciænidæ are almost as numerous as the perches; they are characterised in a great measure by similar habits, and present the same advantages to the human race. They almost all afford excellent eating; of several, indeed, the flavour is exquisite; and a few are of great size. The famous *maigre*, for example (*S. aquila*, Cuv.), commonly weighs about sixty pounds, and sometimes attains to the length of six feet.

A. *Two dorsal fins.*

Genus Sciæna, Cuv. Head gibbous, supported by cavernous bones; two dorsals, or one deeply emarginate, with its softer portion much longer than the spinous; a short anal fin; a dentated pre-opercle; an opercle terminated by points; seven branchial rays.

The species bear a great resemblance to perch, except that they want the teeth upon the palate. Their whole head is scaly, their swimming bladder frequently furnished with remarkable appendages, and the stony bones of the ear are larger than in most fishes. One of the most remarkable is the *maigre* above alluded to (*S. aquila*), called *Umbrina* by the Romans, and held in high esteem even at the present day. (Plate CCXCIX. fig. 10.) It is a rare fish on the outer coasts of Europe, and disappears almost entirely towards the north. The only example with which we are acquainted of its appearance in the northern parts of our own country is recorded by Dr Patrick Neill.[2] It was caught off Ugea in Northmavine, Shetland, in November 1819, and was first observed by the fishermen while endeavouring to escape from a seal. It measured five feet four inches in length, and when lifted into the boat, made its usual "purring sound." Other instances are mentioned by Mr Yarrell. It is, however, extremely common in many parts of the Mediterranean, especially along the Roman states. Paul Jovius mentions that many are taken there at the mouths of rivers, along with sturgeons. They swim in troops, and are said to utter at times a singular low bellowing beneath the waters. It is recorded that three fishermen, guided by this sound, dropt their net on one occasion so successfully as to secure twenty fine fish at a single throw. The noise may be heard at a depth of twenty fathoms, and is often very perceptible when the ear is placed upon the gunnel of the boat. Its tone seems to vary, as some have compared it to a dull buzzing, others to a sharp whistle. Some of the fishermen allege that the

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[1] It appears that we now possess seven British species of stickle-back, of which the *four-spined* (*G. spinulosus*, Yarrell) was discovered by Dr James Stark in the neighbourhood of Edinburgh. He exhibited specimens to the Wernerian Nat. Hist. Society in 1831.

[2] *Edin. New Phil. Journ.* No. 1.

males alone are musical during spawning time, and that it is quite possible to capture them without any bait, merely by imitating this peculiar sound. One alluded to by Cuvier as having been entangled in a net spread along the shore at Dieppe, was at first found sleeping; but on being handled, it roused itself so suddenly, and with such violence, as to precipitate the fisherman into the water, and force him to call for assistance before he could become its master. High, though of course imaginary virtues, were formerly attributed to the stones which occur in the ear of this, as of other osseous fishes. They were worn on the neck, set in gold; and Belon says they were called *colic-stones*, being renowned for the cure, and even prevention, of that complaint. It was necessary, however, that they should be received as a gift,—such as were purchased being found to lose their virtue.

The species above mentioned belongs to the genus Sciæna proper of Cuvier, a subdivision characterised by the feebleness of the anal spines, and by the want of canine teeth and barbles.

Other subdivisions of the principal genus Sciæna are as follows:—Otolithus and Ancylodon are foreign groups (from India and America), which we shall merely name. Corvina of Cuvier differs from Sciæna proper chiefly in the much greater strength of the second anal spine. An abundant species in the Mediterranean is the *C. nigra*, of a silvery brown colour, with the ventral and anal fins black. It occurs in salt marshes and the sea, but does not appear to ascend rivers. It is less esteemed than the maigre, but is not unfrequently sold for that fish in the Italian markets. Johnius of Bloch is closely allied to the preceding. We here figure as an example of that minor group, the *C. dentex* of Cuv., a species from St Domingo. (Plate CCXCIX. fig. 12.) Several of the fishes used as food in India belong to the genus *Johnius*. Their flesh is light, but not highly flavoured. They are called *whitings* by the English in Bengal. The species are tolerably numerous, and inhabit both seas and rivers. Umbrina of Cuvier is distinguished from the other Sciænæ by bearing a barble on the symphysis of the lower jaw. (Ibid. fig. 11.) The species represented (*U. coroides*) is a native of Brazil. The bearded Umbrina (*U. vulgaris*, Cuv.), a species frequent on the coasts of France, Italy, and Spain, was captured in the river Eye in 1827, as recorded in the minute-book of the Linnæan Society. Pogonias, Lacépède, resembles the preceding; but it is furnished with several barbles instead of one. The species are remarkable for their size, some of them weighing occasionally above a hundred pounds, and for the singular sounds uttered by them, and which have gained them the vulgar name of *drums*. Mr John White, an American lieutenant, who (in 1824) published a Voyage to the China Seas, relates, that being at the mouth of the river Cambodia, himself and crew were greatly astonished by certain extraordinary sounds, which were heard from around and beneath the vessel. They resembled a combination of the base of an organ, the sound of bells, and the guttural cries of a large frog, with certain tones, which the imagination might attribute to a gigantic harp. It might almost have been said that the vessel trembled at those uncertain sounds. For some time they increased, and finally formed a loud and universal chorus, the entire length of the vessel, and on either side. In proportion as they ascended the river the mysterious sounds diminished, and finally altogether ceased. The interpreter gave the information that they were produced by a troop of fishes of a flattened oval form, which possess the faculty of adhering firmly to various bodies by their mouths. A similar phenomenon was noticed by the illustrious Humboldt in the South Seas, although he was unable at the time to divine the cause. It would, as Cuvier has remarked, be an object of curious research to discover by what organ these sounds are produced. We have already mentioned, that the majority of the Sciænidæ, especially such as are the most remarkable for the utterance of the sounds in question, have large swimming bladders, furnished with strong muscles. In some species the organ is characterised by prolongations, more or less complicated, which even penetrate the intervals of the ribs. It must, however, be borne in mind that these swimming bladders have no communication with the intestinal canal, nor in general with any part of the exterior. The example of the genus here figured is *P. fasciatus* (*Labrus Grunniens* of Dr Mitchell), a North American species. (Plate CCXCIX. fig. 13.)

Genus Eques, Bloch. Recognisable by a compressed elongated body, raised at the shoulders, and finishing in a point towards the tail; the first dorsal is elevated, the second long and scaly.

All the known species are American. See Plate CCXCIX. fig. 14.

B. *A single dorsal fin.*

a. *Seven branchial rays.*

The genera of this subdivision are Hæmulon, Diagramma, and Pristipoma, foreign groups, of each of which we have figured an example. See Plate CCC. figs. 1, 2, 3.

b. *Less than seven branchial rays.*

This minor group is again subdivisible in accordance with the character of the lateral line. Those in which that part is continuous to the tail are the genera Lobotes (Plate CCC. fig. 4), Cheilodactylus (ibid. fig. 7), Scolopsides (ibid. fig. 6), and Latilus (ibid. fig. 9). Those in which it is interrupted are Amphiprion (ibid. fig. 5), Premnas (ibid. fig. 8), Pomocentrus (ibid. fig. 11), Dascyllus, Glyphisodon (ibid. fig. 10), and Heliases. All these last-named genera consist of small species, which, with few exceptions, are natives of the Indian seas, the shores of which they embellish by the splendour of their colours, which are in general extremely brilliant. They may be perceived swimming about incessantly, and with great vivacity, among the rocks, and in the watery pools left by the ebbing tide. Although for the most part eatable, none of the species furnishes an important article of consumption, on account of the smallness of their size, and their not occurring in numerous shoals.

FAMILY IV.—SPARIDÆ.

The genera of this family, like those of the Sciænidæ, have the palate destitute of teeth, and in their general forms, as well as in several particulars of their organization, they bear a strong alliance to that family; but they have no scales upon the fins. Their muzzle is not gibbous, nor the bones of their head cavernous. There are no dentations to the pre-opercle, nor spines to the opercle. The pylorus is furnished with cæcal appendages. None of the species possesses more than six rays to the branchiæ. They are further divisible according to the form of their teeth.

Genus Sargus, Cuv. Cutting incisors in front of the jaws, almost similar to those of the human race.

The species in general feed on shells and the smaller crustacea, which they easily crush with their molar teeth. Certain kinds appear to devour fuci, at least Cuvier found the stomachs of some which came from the Red Sea, and of others from the Atlantic Ocean, filled with that marine vegetation. Many vague notices of the Sargi are contained in ancient authors. Ælian and Oppian inform us that the male is polygamous, and fights with great fury against his own sex for the possession of many females.

The same authors attribute to it a feeling still more extraordinary,—a lively passion for goats, which it exhibits by always swimming with great rapidity towards those animals, and indulging in playful gambols before them. So blind was this passion, that a fisherman (it was so alleged) might catch as many as he pleased by disguising himself with the skin and horns of a goat, and scattering in the water flour steeped in goats' broth. We have somewhere seen a doggrel rhyme in allusion to this strange and foundationless fancy (it may have been an attempted translation of an ancient epigram), in which it was expressed that the Sargus

> Went courting she-goats on the grassy shore,
> Horning those husbands who had horns before.

The best-known species inhabits the Mediterranean. It is the *S. Rondeletii* of Cuv. (Plate CCC. fig. 12.) The American shores produce several others, one of which (*S. ovis*) is called the *sheep's-head* by the Americans. Dr Mitchell speaks in the most eulogistic terms of the superexcellence of its flesh, and of the high esteem in which it is held at the tables of New York. It yields in his opinion to few fishes, and is worthy of being served at the most sumptuous entertainments. The price varies from a dollar to a dollar and a half for a middle-sized individual, and above that size the price ranges even so high as from four to seven pounds sterling. They sometimes weigh from fourteen to fifteen pounds. The fishery of this species forms an object of importance along the coasts of the state of New York. It approaches those of Long Island in the hot season from the month of June till the middle of September, after which it seems to seek retirement in the deep abysses of the ocean. As they swim in troops, they may be advantageously fished for with the net, and many hundreds are sometimes taken at a single cast. With the great nets used at Rayner town, and the two islands, thousands are drawn ashore. They are immediately packed in ice, and despatched during the cool of the night to the markets of New York. It is difficult to take the *sheep's-head* with a line, because it contrives to snap the very hooks asunder with its cutting teeth.

Genus Chrysophris, Cuv. Round molars on the sides of the jaw, forming at least three rows on the upper one; a few conical or blunted teeth in front.

The species of this genus are numerous, and extended through many seas. Those of the Mediterranean are only two in number, and are called *Daurades* by the French, no doubt from the Latin *Aurata*, a term applied to them by ancient authors. The Greeks named them Chrysophris, which signifies golden eye-brow, in allusion to the brilliant spot of gold which the common species bears between its eyes. That the *Aurata* of the Latins was identical with the *Chrysophris* of the Greeks, may be inferred from a passage in Pliny, which is obviously borrowed from Aristotle, and where the former word is used as the translation of the latter. According to Columella, the Aurata was among the number of the fishes brought up by the Romans in their *vivaria;* and the inventor of these vivaria, one Sergius Orata, is supposed to have derived his surname from the fish in question. Ælian tells us that the Chrysophris is the most timid of all fishes, and that branches of poplars planted in the sand during a reflux so terrified a party of these fishes which were carried upwards by the flux, that in the succeeding reflux they did not dare to pass the poplars, but allowed themselves to be taken by the hand.

The only species we shall here notice is the *Chrysophris aurata* (Plate CCC. fig. 14), described under the name of *Gilt-head* by Pennant.[1] This fish seldom quits the vicinity of the shore, and grows extremely fat in the salt ponds. We owe to Duhamel whatever information we possess regarding its habits. The fishermen informed that author that it agitates the sand forcibly with its tail, so as to discover the shell-fish which may lie beneath concealed. It is extremely fond of muscles, and its near presence is sometimes ascertained by the noise which it makes while breaking their shells with its teeth. It greatly dreads cold, and many were observed to perish during the severe winter of 1766. The Gilt-head is a British species, but of extremely rare occurrence.

Genus Pagrus, Cuv. Differs from the preceding by having only two rows of small rounded molar teeth in each jaw; the front teeth are either like those of a wool card, or small and crowded.

We have figured the best-known species, *Pagrus vulgaris*, Cuv. (*Sp. pagrus*, Linn.), the braize or becker of English authors, which appears to be confined chiefly to the Mediterranean. (See Plate CCC. fig. 13.) Its synonyms seem confused and contradictory, and are greatly mingled in the works both of British and foreign authors with those of certain *Pagelli* and other Sparidæ. Its history as a British species is obscure. Dr Fleming no doubt records it in his *British Animals*, p. 211; but as he indicates it by "a dark spot at the base of the pectorals," it is probable that his actual species was *Pagellus centrodontus*, Cuv. synonymous with *Sparus orphus* of Linn. Mr Couch, however, observes that it appears on the Cornish coast in moderately deep water throughout the summer and autumn, and retires in winter and spring.[2]

Genus Pagellus, Cuv. Teeth nearly resembling those of Pagrus, but the molars, equally in two rows, are smaller; the conical teeth in front are slender and more numerous; and the physiognomy is different in consequence of a more elongated muzzle.

Several species occur in the European seas. *P. erythrinus*, commonly called the Spanish Bream (Plate CCC. fig. 15), is very abundant in the Mediterranean, and even enters the Atlantic, advancing pretty far north. It is very rare along the British shores. The fish figured by Donovan (*British Fishes*, iv. pl. 89) as the *Sparus aurata* of Linn. (Pennant's Gilt-head) belongs to our present genus. It is the *Pagellus centrodontus* just before referred to, which Pennant also erroneously regarded as synonymous with *Sparus pagrus* of Linn. It is by no means a rare British species, although usually concealed by our modern authors under some other name. It is the *sea-bream* of Couch and Montagu.

Genus Dentex, Cuv. Conical teeth even on the sides of the maxillæ, usually in a single row, and of which some of the anterior are lengthened into large hooks.

The *Dentex vulgaris*, a fish of a silvery hue, shaded into blue upon the back, with reddish pectoral fins, and sometimes attaining to the weight of twenty pounds, has occurred upon the Sussex coast. The specimen figured by Donovan, pl. 73, was obtained in Billingsgate market.

Genus Cantharis, Cuv. Teeth small and closely set all round the jaws, the outer range being the strongest; body elevated and thick; muzzle short; jaws not protractile.

The species of this genus, of which four inhabit the European seas, are very voracious, and easily taken by hook and line. We may name as an example the fish called the black bream by Montagu[3] (*Cantharus griseus*,

[1] The *Gilt-head* of Donovan and Turton is, however, another species, the *Pagellus centrodontus*, Cuv.

[2] *Linn. Trans.* vol. xiv. p. 79.

[3] *Mem. of Wernerian Society*, vol. ii. p. 451.

Cuv.; *Pagrus lineatus*, Fleming; *Sparus brama*, Linn.). Other species occur about the Cape of Good Hope, and in the Indian seas; but it does not appear that any have yet been observed along the American shores, or around the islands of the Atlantic.

The genus Boops,[1] with which we shall conclude our sketch of the Sparidæ, has its outer row of teeth of a trenchant or cutting form; the mouth small, and not at all protractile. Two species occur in the European seas, more particularly in the Mediterranean. They differ from most of their congeners in living entirely on marine plants, such as algæ and fuci of various kinds. In accordance with this vegetable diet, their intestinal canal is very long, though they have few appendages around the pylorus. They are celebrated for the beauty of their colours.

FAMILY V.—MENIDÆ.

The genera of this family differ from those of the preceding in their upper jaw being capable of projection and retraction, in consequence of the length of the intermaxillary pedicles, which withdraw between the orbits. Their body is scaly like that of *Sparus*, of which genus they formed a part, until their re-arrangement by Baron Cuvier.

As we have nothing of general interest to state regarding the fishes of this comparatively limited group, we shall merely refer, in relation to its general contents, to our *Systematic Table* (note to page 165), and proceed to

FAMILY VI.—SQUAMMIPENNES.

So called because the softer, and frequently also the spinous portions of the dorsal and anal fins are covered with scales, which as it were encrust them, and render their discrimination from the rest of the body by no means easy. This is the most obvious character of these fishes, of which the form is in general much compressed. The intestines are rather long, and the cæca numerous. This family was comprised by Linnæus in his genus Chætodon, so called from the long, slender, and hair-like character of the teeth; and the species in general are alike remarkable for their singular forms and splendid colours.

The seas of the torrid zone have indeed no cause to envy the productions of those famous lands, the shores of which they have so long bathed with their translucent waters. If the equatorial regions of Africa and America possess, among their feathered tribes, the brilliant souimangas, the lustrous humming birds, and the gorgeous chatterers, the intermediate ocean and the Indian seas contain countless thousands of the finny race which surpass even these in splendour. The Chætodons, in particular, form a family on which nature has bestowed her ornaments with a most lavish hand. The deep purple of the iris, the paler richness of the rose, the azure blue of the "crystalline sky," the darkest velvet black,—these hues, and many more, are seen commingled with metallic lustre over the pearly surface of this resplendent group. The eye of man receives the greater pleasure from their contemplation, in as far as being of moderate size, and haunting habitually the rocky shores, at no great depth of water, they are seen to sport in the sunbeams, as if desirous to exhibit their splendid liveries to the greatest advantage in the blaze of day.

Tribe 1st. Teeth Hair-like.

Genus Chætodon, Cuv. Body more or less elliptical, the spinous and the softer rays continuing in a nearly uniform curve; muzzle more or less advanced; the preopercle sometimes finely dentated.

The species resemble each other not only in the more essential characters just stated, but even in the distribution of their markings. The majority, for example, are characterised by a black vertical band, in which the eye is placed. In some we find several additional vertical bands parallel to the one mentioned; in others they are oblique or horizontal. Certain species are distinguished by a filament which results from the prolongation of one or more of the soft rays of the dorsal fin. The genus is very extensive, containing upwards of sixty species even in its restricted constitution. We must here confine ourselves to a slight notice of two or three of these. *Chætodon reticulatus*, Cuv. (Plate CCCI. fig. 1) is a beautiful example obtained by MM. Lesson and Garnot at Otaheité. Its sides are mailed or reticulated by a longitudinal series of scales. It measures about six inches in length, and four in height. *Ch. lunula*, Cuv. (ibid. fig. 2), occurs at the Isle of France. It is nearly of the same size as the preceding. A third species, of even more singular markings, is *Ch. Ephippium* of the same author (ibid. fig. 3). It was found at the Moluccas by M. Reinwardt—at Bolabola one of the Society Islands, by MM. Lesson and Garnot,—and appears, by a coloured drawing in the Banksian Library, to have likewise occurred at Otaheité during Cook's third voyage.

Genus Chelmon, Cuv. Separated from Chætodon on account of the extraordinary form of the muzzle, which is long and slender, open only at the extremity, and formed by the inordinate horizontal prolongation of the intermaxillary bone above, and of the inferior jaw. These parts are united for two thirds of their length by a membrane, so that the mouth is nothing more than a small terminal cleft. The teeth are rather fine and closely set than hair-like. *Chelmon rostratus* (*Chæt. rost.* Linn.) is the most anciently known. It is a small fish, measuring from six to eight inches in length, and is remarkable for the following peculiarity. It feeds on flies and other winged insects, and when it perceives one of these either hovering over the surface, or settled on a twig or blade of grass, it ejects against it with considerable force a drop of liquid from ist tubular snout, so as to drive it into the water. In shooting at a sitting insect it generally approaches cautiously within a few feet before it explodes the water. Schlosser has described this curious device in the *Philosophical Transactions* for 1764, after Hummel, and it has since been confirmed by Reinwardt. It is even said to be an amusement of the Chinese in Java to keep this fish in confinement in a large vessel of water, with a view to observe its dexterity in the practice of this admirable instinct. They fasten a fly or other insect to the side of the vessel, when the Chelmon immediately bombards it with such precision as very rarely to miss the mark. In a state of nature it is said to inhabit both the coasts and rivers of Java. We are as yet acquainted with only one other species of this restricted genus. It is the *Ch. longirostris* of Broussonet, of which the reader will find an accurate representation on Plate CCCI. fig. 5. It is not known *de facto* to possess the same singular mode of capturing its prey as the preceding, but that it does so may be almost inferred from its similarity of structure.

Genus Henochius, Cuv. Differs from Chætodon in the spines of the back, particularly the third and fourth, being greatly increased in length, and forming a filament sometimes double the length of the body.

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[1] The generic name is changed to Box in the *Hist. Nat. des Poissons*, t. vi. p. 346.

Acanthopterygii. Squammipennes.

H. macrolepidotus is a large fish, celebrated in the East for the excellence of its flavour. It is called *Vlagman* by the Dutch colonists, in allusion to the long filament upon the back. They also name it *Tafel-visch*, on account of its frequent use as food. Ruysch asserts that at Amboyna no good dinner is ever served without it, and he compares its taste to that of the finest flounder. The specimens hitherto sent to Europe do not seem to exceed the length of ten inches; but the species must at times greatly exceed that size, if, as Renard and Valentyn assert, it weighs from twenty to twenty-five pounds. As an example of this extraordinary genus we have figured *Henochius monoceros*, a species recently transmitted from the Isle of France by MM. Quoy and Gaimard, Plate CCCI. fig. 4. The specimen represented does not measure above seven inches, and its height is almost equal to its length.

The genus Zanclus of Commerson is closely allied to the preceding, but the scaling is so much more delicate that the skin appears almost smooth to the naked eye. The external aspect is, if possible, still more extraordinary. We have here engraved *L. cornutus* of Cuv. (Plate CCCI. fig. 8), which, on account probably of its singular form and horned front, has become an object almost of superstitious reverence among the fishermen of the Moluccas. It is alleged, that when they happen to capture one of this species, they immediately salute it by certain genuflexions, and then cast it into the sea. It is, however, an excellent table fish, which attains a weight of fifteen pounds, and resembles the turbot in flavour. It is rather widely diffused, occurring both in the Indian seas and Pacific Ocean.

Genus Ephippus, Cuv. Distinguished by a deep emargination between the spinous and softer portion of the dorsal fin; the former part has no scales, and can be folded into a groove on the back.

An American species (*E. gigas*) is remarkable for the great club-shaped enlargement of the first inter-spinal of the anal and dorsal fins, and by a similar enlargement of the crest of the cranium. A fish which may be referred to a subdivision of this genus, occurs among the fossils of Mount Bolca.[1]

Baron Cuvier has remarked,[2] that among all the strange and fantastic fishes preserved in the representations of Ruysch, Renard, and Valentyn,[3] and which have so long excited the mistrust of naturalists, none seems more likely to provoke that feeling than the species which these writers designate by the Malay name of *Skankarbauw*, or buffalo-fish; and yet it now turns out that none is more accordant with the truth of nature. Its sharp recurved horns, the protuberance above the head, the compressed and unequal spines, and the singular distribution of colour, —all exist in a species recently received from the Indian Archipelago. It has accordingly been named Taurichthys by Cuvier,—the Greek translation of the Malay name. The species here figured is *T. varius*, which is from four to six inches long, with a height almost equal to its length. See Plate CCCI. fig. 7.

Genus Holacanthus, Lacép. A large spine at the angle of the pre-opercle, the margins of which are usually dentated.

The species are remarkable for the great beauty and symmetrical distribution of their colours, and for their excellence as articles of food. They are numerous both in the Indian and American seas. One of the most celebrated for the splendour and singularity of its aspect, is that named the *Emperor of Japan* by the Dutch, *Chætodon Imperator* of Bloch, figured in many works. Its body is deep blue, traversed all over by about two and thirty narrow bands of orange yellow.[4] The pectoral fins are black, and the entire tail bright yellow. It is a large fish of its kind, sometimes attaining the length of fifteen inches, and, as an article of food, is one of the most esteemed of all the Indian species, resembling our own much-prized salmon in flavour. Another and more recently discovered species is *H. semicirculatus*, Cuv. It occurs both at Timor and New Ireland. Its colours are white and blue, its length from four to five inches. The inhabitants of Waigiou call it *Mami*.

Genus Platax, Cuv. Anterior to the brush-like teeth, a row of cutting teeth, each of which is divided into three points; body much compressed, and apparently prolonged into thick, greatly elevated, scaly, vertical fins, in the anterior edge of which a small number of spines lie concealed.

Almost all the known species occur either in the Indian or Pacific Oceans. One or two were found by Ruppell in the Red Sea. They are esteemed as food. Words can convey but a feeble idea of the anomalous form of these fishes, some of which, if we include the vertical fins, are more than twice as high as they are long. We here figure the *Chætodon teira* of Bloch, which is a true Platax, Plate CCCI. fig. 6. It was brought by M. Dussumier from the coast of Malabar. It is said to attain to the length of two feet, a great size for a fish of this genus, many of which measure only a few inches. *P. punctulatus*, indeed, may be regarded as one of the smallest of known fishes, as it is only an inch long. It occurs at Timor.

Genus Psettus, Commerson. Form resembling the preceding; but all the teeth are small and crowded, and the ventral fins are reduced to a single small spine, without soft rays.

The species are natives of the Indian seas. Their teeth are rather short and close than in the usual bristle-like form of our present tribe of Squammipennes, yet they cannot be arranged under tribe third, in as far as they want the teeth upon the palate. The *Chætodon rhombeus* of Bloch and Schneider belongs to this genus. It was anciently represented by Seba (t. iii. pl. 26, fig. 21), and now bears the name of *Psettus Sebæ*. The species is extremely rare, and its native country was unknown, till in recent times a specimen was transmitted from the Senegal coast by M. Perottet. It measures six inches in length, and is considerably higher than long. See Plate CCCII. fig. 1.

Tribe 2d. With cutting teeth.

Genus Pimelepterus, Lacép. Distinguished from all other fishes by a single range of teeth borne upon a ho-

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[1] *Ittiol. Veronese*, plate 5, fig. 2.

[2] *Hist. Nat. des Poissons*, t. vii. p. 146.

[3] The works alluded to above are the following:—1. The *Theatrum Animalium* of Henry Ruysch (son of the celebrated anatomist), two vols. in folio, Amsterd. 1718, which is in fact a third edition of Johnston's prior work of the same name, with the addition of the plates of fishes, to be afterwards noticed. 2. A Dutch work entitled East India, Ancient and Modern, in five vols. folio, Amsterd. 1724-26. The author was Francis Valentyn, a Protestant clergyman of Amboyna. 3. A Collection of Figures of Fish, and other Marine Creatures, published by Francis Renard, in one vol. folio, Amsterd. 1754. This *recueil* was formed about thirty years prior to its publication, and was engraved from a collection of native Indian drawings, which, under a necessarily extraordinary aspect, are now known to exhibit with accuracy many truly interesting species. The same series of drawings, or a corresponding copy, seems to have supplied the originals of both the other works just named.

[4] Shaw describes this magnificent fish as of a "golden-yellow, longitudinally but somewhat obliquely striped with very numerous bright blue parallel rays." This seems in some measure the reverse of the above, but is accounted for by the equal proportion of the two colours, either of which may be regarded as the groundwork.

rizontal base or heel, on the anterior edge of which is a vertical cutting portion. The body is oblong, the head obtuse, and the fins rendered thick by means of the scales with which they are covered.

P. Boscii is a small Atlantic species, which measures about five inches in length. Bosc, by whom it was brought from the coast of Carolina, has seen it following vessels in the high seas, and assembling in troops around the stern, in order to seize upon whatever is thrown overboard. It is shy at seizing a hook, and is said to know how to carry off the bait without being captured. It is sought after as food by the French, though held in slight esteem by the natives of Britain.

The only other genus of this tribe is that named Dipterodon by Lacépède.

Tribe 3d. Teeth either close-set or en carde *on the jaws and palate.*

Genus Brama, Bloch and Schneider. Pertains to our present family, so far as concerns the scales which cover the vertical fins, which have only a small number of spiny rays concealed in their anterior margins; but the teeth are *en carde* on the jaws and palate, the profile elevated, the muzzle very short, the front descending vertically, the mouth almost vertical when closed. The scales reach as far as the maxillaries; there are seven rays to the gills; a low dorsal and anal fin, each commencing by a salient point; a short stomach, a small intestine, and only five cæca.

Of this genus there was known till recently only a single species, that of the Mediterranean, the *Sparus Raii* of Bloch.

It is only of late that its characters and history have been rendered in any way clear or satisfactory—a fact the more remarkable when we consider its large size, its singular form, its extreme abundance, and the exquisite flavour of its flesh. In spite of all these circumstances, most modern authors seem to have written regarding it as if they were blindfolded. Bloch regarded it as a northern fish, simply because so far back as 1681 a specimen was thrown ashore on our Yorkshire coast; and Lacépède describes it as an oceanic species. The individual above alluded to was described by Ray in his Synopsis (p. 115), under the title of *Brama marina cauda forcipata*. Pennant figures and describes it in his British Zoology (2d edition) by the name of *toothed Gilt-head*, and it seems indicated by Mr Couch (in *Linn. Trans.* xiv. 78) as a Chætodon seen off the coast of Cornwall. There is no doubt that its central dominion is in the Mediterranean, as it is extremely common along many coasts of that inland sea.[1] It is called *Rondanin* in the markets of Genoa. At the same time there is no doubt that it wanders occasionally as far north even as Denmark, and that many accidental specimens have been captured along both the British and Irish shores. Two other species have lately been discovered in the equatorial seas.

Genus Toxotes, Cuv. Body short and compressed; dorsal situate on the hinder part of the back, strongly spined, its softer portion, as well as the corresponding part of the anal, scaly; muzzle depressed, short; lower jaw more advanced than the upper; small close-set teeth in either jaw, on the vomer, the palatines, the pterygoids, and tongue; six branchial rays; very fine dentations on the inferior margin of the sub-orbital bone and preopercle. Stomach short and broad; twelve cæcal appendages upon the pylorus; swimming bladder large and thin.

The *Toxotes jaculator* (Plate CCCII. fig. 2) is a small Javanese species, measuring six or seven inches in length, remarkable for possessing the same faculty as that mentioned in our notice of *Chelmon rostratus*. When it perceives a fly or other insect upon an aquatic plant, it dexterously drives it into the water by a shower of drops. Cuvier received a specimen from Batavia, the stomach of which was entirely filled with ants. This species has been erroneously multiplied in systematic works. It is twice described by Shaw[2] under two different names (*Scarus Schlosseri* and *Labrus jaculator*), neither of which is the right one; and there is no doubt of its being identical with Hamilton Buchanan's *Coius chatereus*, a supposed new species from the Ganges.[3] It seems pretty widely distributed throughout the Indian Archipelago, and is known to the Malays by the name of *Ikan-sumpit.*

FAMILY VII.—SCOMBERIDÆ.

One of the most useful to the human race of the entire class of fishes, whether we consider their agreeable flavour, their considerable size, or their inexhaustible productive powers. We may mention the mackerel, the tunny, and bonito, as familiar examples.

When considered isolately, these celebrated fishes are by no means difficult to characterise. The simple separation of the posterior of the second dorsal, and of those of the anal fin, would of itself suffice; but the species above named are the chiefs of a numerous series of genera and sub-genera, in which the more typical form gradually alters, and passes insensibly into others which do not exhibit either the character just mentioned, or almost any other by which the principal types are distinguished. Scales usually very small, causing the greater part of the skin to appear as if entirely smooth; opercular pieces without spines or dentations, and in general numerous cæca;—these are almost the only prevailing characters which can be assigned to the family, which at the same time exhibits a likeness in the aspect of its constituent groups which never leaves it. In short, it forms what botanists call a family by series or transition. The majority have the sides of the caudal extremity carinated, or armed with scales or shields, which are themselves carinated; or the terminal rays of the second dorsal or of the anal are free; or the spiny rays of that dorsal want their uniting membrane. Most frequently the caudal fin is of great size, and corresponding vigour. In the majority, also, the first spiny rays of the anal fin are separated from the others, and form, as it were, a small distinct fin by themselves. But none of these characters is common to the whole.

We may here group, as forming the First Great Tribe, those genera of which the *anterior dorsal fin is entire, but the terminal rays of the posterior one are detached or isolated, forming what may be called finlets or spurious fins* (*pinnæ spuriæ*).

Genus Scomber, Cuv. The mackerels, properly so called, have a fusiform body covered by scales, uniformly small and smooth; sides of the tail not carinated, but merely raised into two small cutaneous crests; a vacant space between the first and second dorsal fin.

The common mackerel (*Sc. scombrus*) is one of the most beautiful of fishes, and too well known to require a

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[1] Mr Yarrell, however, has brought together various instances of its occurrence along the British shores; and as it is mentioned by Nilsson in his *Prodromus* as occurring on the coast of Norway, and by Reinhardt as a Danish species, it rather appears that Baron Cuvier regarded *Ray's Bream* too exclusively as a Mediterranean species.

[2] *General Zoology*, vol. iv. part ii. pp. 398, 485.

[3] *Fishes of the Ganges*, part 201, plate 14, fig. 34.

Acanthop-terygii. Scomberidæ.

minute description. The back is blue, crossed by many dark transverse bands, nearly straight in the males, but finely waved in the females. The sides and abdomen are of a silvery hue, glossed with brilliant tints of gold. The name is said to refer to the spotted appearance of the upper parts, and to be derived from the Latin *macularius*. We shall here avail ourselves of Mr Yarrell's history of this important species.

"The mackerel was supposed by Anderson, Duhamel, and others, to be a fish of passage, performing, like some birds, certain periodical migrations, and making long voyages from north to south at one season of the year, and the reverse at another. It does not appear to have been sufficiently considered, that, inhabiting a medium which varied but little either in its temperature or productions, locally, fishes are removed beyond the influence of the two principal causes which make a temporary change of situation necessary. Independently of the difficulty of tracing the course pursued through so vast an expanse of water, the order of the appearance of the fish at different places on the shores of the temperate and southern parts of Europe is the reverse of that which, according to their theory, ought to have happened. It is known that this fish is now taken, even on some parts of our own coast, in every month of the year. It is probable that the mackerel inhabits almost the whole of the European seas; and the law of nature which obliges them and many others to visit the shallower water of the shores at a particular season, appears to be one of those wise and bountiful provisions of the Creator, by which not only is the species perpetuated with the greatest certainty, but a large portion of the parent animals are thus brought within the reach of man, who, but for the action of this law, would be deprived of many of those species most valuable to him as food. For the mackerel dispersed over the immense surface of the deep, no effective fishery could be carried on; but, approaching the shore as they do from all directions, and roving along the coast collected in immense shoals, millions are caught, which yet form but a very small portion compared with the myriads that escape.

"This subject receives farther illustration from a fresh-water fish, as stated in the Magazine of Natural History, vol. vii. p. 637: 'When the char spawn, they are seen in the shallow parts of the rocky lakes (in which only they are found), and some of the streams that run into them: they are then taken in abundance, but so soon as the spawning is over, they retire into the deepest parts of the lake, and are but rarely caught.'

"It may be observed farther, that as there is scarcely a month throughout the year in which the fishes of some one or more species are not brought within the reach of man by the operation of the imperative law of nature referred to, a constant succession of wholesome food is thus spread before him, which, in the first instance, costs him little beyond the exercise of his ingenuity and labour to obtain.

"On the coast of Ireland, the mackerel is taken from the county of Kerry in the west, along the southern shore, eastward to Cork and Waterford; from thence northward to Antrim, and north-west to Londonderry and Donegal. Dr M'Culloch says it visits some of the lochs of the Western Islands, but is not considered very abundant. On the Cornish coast this fish in some seasons occurs as early as the month of March, and appears to be pursuing a course from west to east. They are plentiful on the Devonshire coast, and swarm in West Bay about June. On the Hampshire and Sussex coast, particularly the latter, they arrive as early as March; and sometimes, as will be shown, even in February: and the earlier in the year the fishermen go to look for them, the farther from the shore do they seek for and find them. Duhamel says the mackerel are caught earlier at Dunkirk than at Dieppe or Havre: upon our own eastern coast, however, the fishing is later. The fishermen of Lowestoffe and Yarmouth gain their great harvest from the mackerel in May and June. Mr Neill says they occur in the Forth at the end of summer; and Mr Low, in his *Fauna Orcadensis*, states that they do not make their appearance there till the last week in July or the first week in August.

"The mackerel spawns in June; and, according to Bloch, five hundred and forty thousand ova have been counted in one female. I have observed, by the mackerel sent to the London market from the shallow shores of Worthing and its vicinity, that these fish mature and deposit their roe earlier on that flat sandy shore than those caught in the deep water off Brighton. The young mackerel, which are called shiners, are from four to six inches long by the end of August. They are half grown by November; when they retire, says Mr Couch, 'to deep water, and are seen no more that winter: but the adult fishes never wholly quit the Cornish coast; and it is common to see some taken with lines in every month of the year.' Their principal food is probably the fry of other fish; and at Hastings the mackerel follow towards the shore a small species of *Clupea*, which is there called, in consequence, the mackerel mint. I have been unable hitherto to obtain any specimens of this small fish; but, from various descriptions, I think it is probably the young of the sprat. It is described as being about one inch long in July.

"The mackerel as feeders are voracious, and their growth is rapid. The ordinary length varies from fourteen to sixteen inches, and their weight is about two pounds each; but they are said to attain the length of twenty inches, with a proportionate increase in weight. The largest fish are not, however, considered the best for the table.

"As an article of food they are in great request; and those taken in the months of May and June are generally considered to be superior in flavour to those taken either earlier in spring, or in autumn. To be eaten in perfection, this fish should be very fresh. As it soon becomes unfit for food, some facilities in the way of sale have been afforded to the dealers in a commodity so perishable. Mackerel were first allowed to be cried through the streets of London on a Sunday in 1698, and the practice prevails to the present time.

"At our various fishing towns on the coast, the mackerel season is one of great bustle and activity. The frequent departures and arrivals of boats at this time form a lively contrast to the more ordinary routine of other periods; the high price obtained for the early cargoes, and the large return gained generally from the enormous numbers of this fish sometimes captured in a single night, being the inducement to great exertions. A few particulars from various sources may not be uninteresting.

"In May 1807, the first Brighton boat-load of mackerel sold at Billingsgate for forty guineas per hundred—seven shillings each, reckoning six score to a hundred; the highest price ever known at that market. The next boat-load produced but thirteen guineas per hundred. Mackerel were so plentiful at Dover in 1808 that they were sold sixty for a shilling. At Brighton, in June of the same year, the shoal of mackerel was so great, that one of the boats had the meshes of her nets so completely occupied by them, that it was impossible to drag them in; the fish and nets, therefore, in the end, sunk together, the fishermen thereby sustaining a loss of nearly sixty pounds, exclusive of what the cargo, could it have been got into the boat, would have produced. The success of the fishery in 1821 was beyond all precedent. The value of the catch of sixteen boats from Lowestoffe, on the 30th of June, amounted to L.5252; and it is supposed that there was no less an amount than L.14,000 altogether realised by the owners and men concerned in the fishery of the Suffolk coast.[1] In March 1833, on a Sunday, four Hastings' boats brought on shore ten thousand eight hundred mackerel; and the next day two boats brought seven thousand fish. Early in the month of February 1834, one boat's crew from Hastings cleared L.100 by the fish caught in one night; and a large quantity of very fine mackerel appeared in the London market in the second week of the same month. They were cried through the streets of London three for a shilling on the 14th and 22d of March 1834, and had then been plentiful for a month. The boats engaged in fishing are usually attended by other fast-sailing vessels, which are sent away with the fish taken. From some situations these vessels sail away direct for the London market; at others they make for the nearest point from which they can obtain land-carriage for their fish. From Hastings and other fishing towns on the Sussex coast the fish are brought to London by vans, which travel up during the night.

"The most common mode of fishing for mackerel, and the way in which the greatest numbers are taken, is by drift-nets. The drift-net is twenty feet deep, by one hundred and twenty feet long; well corked at the top, but without lead at the bottom. They are made of small fine twine, which is tanned of a reddish-brown colour, to preserve it from the action of the sea-water; and it is thereby rendered much more durable. The size of the mesh is about two and a half inches, or rather larger. Twelve, fifteen, and sometimes eighteen of these nets are attached lengthways, by tying along a thick rope, called the drift-rope, and at the ends of each net, to each other. When arranged for depositing in the sea, a large buoy attached to the end of the drift-rope is thrown overboard, the vessel is put before the wind, and, as she sails along, the rope, with the nets thus attached, is passed over the stern into the water till the whole of the nets are run out. The net thus deposited hangs suspended in the water perpendicularly twenty feet deep from the drift-rope, and extending from three quarters of a mile to a mile, or even a mile and a half, depending on the number of nets belonging to the party or company engaged in fishing together. When the whole of the nets are thus handed out, the drift-rope is shifted from the stern to the bow of the vessel, and she rides by it as if at anchor. The benefit gained by the boat's hanging at the end of the drift-rope is, that the net is kept strained in a straight line, which, without this pull upon it, would not be the case. The nets are shot in the evening, and sometimes hauled once during the night, at others allowed to remain in the water all night. The fish roving in the dark through the water, hang in the meshes of the net, which are large enough to admit them beyond the gill-covers and pectoral fins, but not large enough to allow the thickest part of the body to pass through. In the morning early, preparations are made for hauling the nets. A capstan on the deck is manned, about which two turns of the drift-rope are taken. One man stands forward to untie the upper edge of each net from the drift-rope, which is called casting off the lashings; others hand in the net with the fish caught, to which one side of the vessel is devoted; the other side is occupied by the drift-rope, which is wound in by the men at the capstan. The whole of the net in, and the fish secured, the vessel runs back into harbour with her fish; or, depositing them on board some other boat in company, that carries for the party to the nearest market, the fishing vessel remains at sea for the next night's operation."[2]

Another mode of fishing is with a hook and line, angled with a coarse rod, from a boat under rapid sail. A slice from the mackerel's own body affords an excellent bait, and even a piece of scarlet cloth or leather is often used with great success. The line is weighed down by a heavy plummet; and when the fish are numerous, two men will thus capture from 500 to 1000 in a single day. It is a singular fact, that the common mackerel has no swimming bladder, although that organ is found in several closely allied species. What necessity of nature, Cuvier asks, can require it in the one, and not in the other? What can have produced it? These are great problems, both in the study of final causes, and in the general philosophy of nature.

Genus Thynnus, Cuv. A kind of corslet round the thorax, formed by scales larger and coarser than those of the rest of the body; sides of the tail with a cartilaginous keel between the two crests above mentioned. The anterior dorsal is prolonged almost to the posterior one.

The tunny (*Th. vulgaris*, Cuv.; *Scomber thynnus*, Linn.), (Plate CCCII. fig. 3), is one of the largest fishes of the ocean.[3] When it weighs only a hundred pounds, the Sardinians give it the name of *scampirro*, a diminutive derived from Scomber. When above that weight, and onwards to three hundred pounds, it is called *mezzo-tonno*, or half tunny. The larger individuals frequently weigh a thousand pounds; and Cetti asserts that old males are taken occasionally weighing eighteen hundred pounds.[4] The fishery of the tunny dates from the most remote antiquity; and the city of Byzantium was more especially enriched by it. The shoals which entered the Bosphorus were said to meet near Chalcedon with a white rock, which so terrified them that they turned into the Gulf of Byzantium, now the port of Constantinople. It was, according to Cuvier, in consequence of this abundance of tunnies, that the gulf in question received the name of the *Golden Horn;* and the oracle of Apollo designated Chalcedon as the *City of the Blind*, because its founders did not perceive the inferiority of its site in relation to these valued fish. Gibbon, however, tells us, that "the curve which it describes might be compared to the horn of a stag, or, as it should seem, with more propriety, to that of an ox. The epithet *golden* was expressive of the riches which every wind wafted from the most distant countries into the secure and capacious port of Constantinople." The same prodigious quantities of the tunny are still seen there as in ancient times. According to Syllius, twenty vessels might be filled by a single cast of the net; and they may frequently be taken by the hand without the aid of nets. When ascending towards the port, they may be killed with stones; and even women take them in quantities, merely by suspending a large basket by a cord from the windows.[5] The tunny fishery was of still more ancient practice in the West. The Phœnicians established it at a very early period on the coasts of Spain, both within and beyond the columns of Hercules. It is thus that we find the tunny on the Phœnician medals of Cadiz and Carteia. Its salted preparation was known to the Romans as an esteemed article, under the name of *Saltamentum Sardicum*.

The tunny fishery does not seem to be now carried on

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[1] "In an interesting and useful sketch of the natural history of Yarmouth and its neighbourhood, by C. and J. Paget, it is stated at p. 16, that in 1823, one hundred and forty-two lasts of mackerel were taken there. A last is ten thousand."

[2] *British Fishes*, p. 121.

[3] We may here note, in regard to the engraved illustrations of the present treatise, that we found it impossible to maintain a proportional size in our figures. Thus the *tunny*, a gigantic species, appears, upon the plate above referred to, as smaller than its neighbour *Toxotes jaculator*, which is scarcely more than half a foot long.

[4] *Histoire Naturelle de Sardaigne*, t. iii. 134, 135.

[5] *De Constantinop. Topographia*, in præf.

at Constantinople on a great or systematic scale, but is chiefly concentrated in the interior of the Mediterranean. The species sometimes wanders along the British shores; and a fine specimen, measuring nine feet in length, was killed in the beautiful Gairloch, opposite Greenock, in July 1831. It is preserved in the Andersonian Museum, Glasgow.

The fish known to navigators under the name of *Bonito* belongs to our present genus. It is the *Th. pelamys* of Cuv. and sometimes occurs along the British shores. It resembles the tunny in form, but is a great deal smaller, seldom exceeding the length of thirty inches. It is celebrated in the tropical seas for its eager pursuit of the flying fish. The bonito of the Mediterranean, however, be it remembered, belongs to the following genus.

Genus Auxis, Cuv. Corselet and pectoral fins as in Thynnus; but the dorsal fins distant, as in Scomber.

We here engrave (Plate CCCII. fig. 5) a species common in the Mediterranean, where it is called bonito, *Auxis vulgaris*, Cuv. It is of a fine blue colour above, with oblique blackish lines. The flesh is red and coarse. We have eaten it during a voyage to Genoa, in the course of which the vessel was followed by a flock for an entire day. We struck them with a small harpoon from the bowsprit. The species seldom exceeds six pounds.

In regard to the genus Pelamys of Cuv.[1] we shall here merely state, that it is distinguished from the tunnies by its strong, separate, and pointed teeth. The vague name of bonito is likewise applied to one of the species, the *Scomber sarda* of Bloch, common in the Mediterranean. The genus Cybium has the body elongated, without corselet, the teeth large, compressed, cutting, in the form of lancets. On the palatines there are only the close-set kind of teeth. The species inhabit the warmer parts both of the Atlantic and Pacific Oceans, and some of them attain a great size. The genus Thyrsites differs from the preceding in having the anterior teeth longer than the others, as well as the palatines being furnished with pointed teeth.

The genus Gempylus is allied in many respects to that last named, but it wants the teeth upon the palate, and the ventrals are almost imperceptible. See Plate CCCII. fig. 6, where we have represented *G. prometheus*, Cuv., a species discovered at St Helena, by Messrs Quoy and Gaimard.

We shall here briefly notice two genera which cannot be better placed than in succession to the preceding Scomberidæ. We allude to Lepidopus and Trichiurus,[2] which resemble the two last-named groups in almost every thing, except that they entirely want the finlets, or false fins, and even the soft rays of the dorsal. There is merely a vestige of the ventral fins. It is a singular thing, as Cuvier has observed, that a fish so generally met with as the great *Lepidopus argyreus* of the European seas (there is no other species), so handsome, and so large, should have remained unknown to naturalists so recently as the end of the eighteenth century, and that it should have been afterwards successively described by various writers, under a new name, and by each in ignorance of the labours of his predecessor. If we figure to ourselves a large and broad riband of silver, swimming with a wavy motion through the water, and casting from it in its progress the most beautiful reflections of light, we may form some notion of the general aspect of this creature in its living state. Its length, as described by Montagu[3] (under the name of *Zipotheca tetradens*), was five feet six inches, with a depth at the gills of four inches and a half; it gradually decreased from the vent to the commencement of the anal fin, where it measured only two inches in depth; at the end of that fin the form was nearly round, and the diameter only half an inch. The weight, without the intestines, was about six pounds. Montagu's specimen was taken in Salcomb Harbour, on the coast of South Devon, on the 4th June 1808. It was swimming with astonishing velocity, *with its head above water*, going, as the fishermen said, "as swift as a bird," and was killed by the blow of an oar. It occurs occasionally on most of the European coasts; is more frequent in some parts of the Mediterranean; and has been captured as far south as the Cape of Good Hope. See our representation on Plate CCCII. fig. 4.

Acanthopterygii. Scomberidæ.

The other genus to which we have alluded, that of Trichiurus, Linn., resembles the preceding in its head and teeth, but it has not even a vestige of a ventral fin; the anal is replaced by a series of very small spines, which scarcely project above the skin, and the tail terminates in a filament or lengthened point, without any caudal fin. We here figure (Plate CCCII. fig. 8) an Indian species, named *Trichiurus savala* by Cuvier. We believe it is synonymous with *T. armatus* of Mr Gray's *Illustrations of Indian Zoology*. Some additional species are figured in Mr Griffith's valuable edition of the *Animal Kingdom*, and that called the silvery hair-tail, or blade fish (*T. lepturus*, Linn.), was some years ago cast ashore on the Moray Firth.[4]

Another group of Scomberidæ, or rather a branch of the first great tribe, contains the sword-fish, and a few other species, which modern Ichthyologists, anterior to the time of Cuvier, placed too much apart from each other, solely because some were possessed of ventral fins, while in others those parts were wanting, "différence," observes our author, "qui ne sert qu'à prouver de plus en plus le peu d'importance de ces nageoires pour un méthode naturelle."[5] Their relationship to the tunnies and mackerels has been still less appreciated, although very obvious in the form of the tail, the structure of the intestines, the quality of the flesh, and even in the parasitical animals by which they are infested; but as they differ in wanting the false fins, all actual resemblances have been set aside, at least in regard to such as are destitute of ventral fins.

Genus Xiphias, Linn. Pertains to the family Scomberidæ, and approaches the tunnies especially in the extreme smallness of the scales, the carination of the sides of the tail, the strength of the caudal fin, and the whole of the interior organization. The distinctive character consists in the lengthened beak or sword-like prolongation of the muzzle or upper jaw, which forms a powerful weapon of offence, and enables them to attack and overcome the largest marine animals. This beak is composed chiefly of the vomer and intermaxillaries, strengthened towards the base by the ethmoid, the frontals, and maxillaries. The branchiæ are not divided like the toothing of a comb, but formed each of two large parallel plates, of which the surface is reticulated. The rapidity of their course is excessive, the quality of their flesh excellent.

Such is a brief indication of the characters of the genus *Xiphias* of Linnæus, which has been divided as follows, in more recent times.

1*st*. Genus Xiphias proper, Cuv. No ventral fin.

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[1] *Hist. Nat. des Poissons*, t. viii. p. 149. The genus Pelamys corresponds to that named Sarda in the second edition of the *Règne Animal*, t. ii. p. 199.

[2] Both genera were formerly placed by Cuvier in the ensuing family Tænioidæ. (See *Règne Animal*, t. ii. p. 217.)

[3] *Memoirs of the Wernerian Nat. Hist. Society*, vol. i. p. 82.

[4] *Linn. Trans.* vol. xi. p. 200.

[5] *Hist. Nat. des Poissons*, t. viii. p. 254.

The only known species seems to have received the same name from all nations. *Gladius*, *Epée*, *Dard*, *Pesce-spada*, *Schwerd-fish*, *Sword-fish*, and the Greek generic name of *Xiphias*, all indicate the formidable weapon with which the front is armed. So remarkable a creature in size and structure could indeed have scarcely remained unknown at any period. All ancient writers within whose province it could possibly fall, speak of it in such a manner as clearly to prove an intimate knowledge of its nature. They describe its offensive weapon, the blows which it inflicts, the dreadful combats which it sustains, the attacks which are made upon it, and the stratagems by which, in spite of its strength, it is lured to its destruction. Although, in relation to its European distribution, the Mediterranean may be said to be its chief dominion, yet the older individuals especially often enter the ocean, and astonish the natives of colder climes by spreading along the northern shores. It has been frequently captured on the British coasts. It even enters the Baltic, and has been seen near Lubeck, of an enormous size.[1] Pennant is doubtful of its occurrence as a North American species, although it is named as such by Catesby. It is not noticed by Dr Mitchell, in his description of the fishes of New York, and for this reason Baron Cuvier does not admit that it crosses the Atlantic. It is, however, fully described by Dr Smith, in his *Fishes of Massachusetts;* and the same writer assures us, on the authority of an old pilot, that the sword-fish is by no means uncommon off that portion of the American shore. It cannot, however, be traced far south in any part of the western world; whilst, like many of the Mediterranean species, it advances along the African coast as far as the Cape of Good Hope.

The fish now alluded to is the *Xiphias gladius*, Linn. (Plate CCCII. fig. 7.) Its horizontal snout is flat and cutting, like the blade of a sword. The sides of its tail are strongly carinated. It has but one dorsal fin, which rises both before and behind, but of which the middle portion in the adults becomes in some manner so worn away, that an appearance is at last presented of two dorsal fins. This will be perfectly understood by comparing the figure last referred to, with fig. 10 of the same plate, where we have represented the young of the present species.[2]

Sword-fish, though by no means uncommon, are seldom captured, owing to their extreme vigilance. Captain Beechey informs us, that while in the Pacific Ocean, near Easter Island, "as the line was hauling in, a large sword-fish bit at the tin case which contained our thermometer, but fortunately failed in carrying it off." Their mode of capture in the Mediterranean may be likened to whale fishing in miniature, and is said to be a very amusing and exciting sport. A watchman placed upon a mast, or standing on the summit of a neighbouring rock, gives warning by signal when he sees a fish approach. The fishermen then row towards it; and, being so skilful as frequently to strike the fish from a great distance, they throw a harpoon into it attached to a long line. An arduous struggle then commences, during which the aggressors are sometimes pulled about by the fish for many hours before they can get it into the boat.

We shall conclude by observing, that the sword-fish is not only one of the largest species of the European seas, attaining sometimes to a length of fifteen feet, but that it is also much esteemed as an article of diet. When young, especially, the flesh is white, firm, and of excellent flavour.

2*d*. Genus Tetrapterus, Rafinesque.[3] Point of the muzzle shaped like a stiletto; ventrals consisting each of one unjointed slender bone; two small projecting crests, like those of the mackerel, at each side of the base of the caudal fin.

The sole European species is *T. belone* of the Italian author. It is a large Mediterranean species, of about six feet in length, and weighing from 150 to 200 pounds.

3*d*. Genus Makaira, Lacép. Possesses the points of the two small caudal crests of the preceding genus, but it wants the ventral fins.

We shall merely mention as an example the *X. Makaira*, or short-snouted sword-fish of Shaw.[4]

4*th*. Genus Histiophorus, Lacép. Characterised by the beak and caudal crests of Tetrapterus, but the dorsal fin is so greatly elevated as to serve as a sail when swimming on the surface, and the ventrals are long, slender, and composed of two rays.

This genus contains that large and showy species (*H. indicus*, Plate CCCII. fig. 9) known to the Malays by the name of fan-fish, and called by the corresponding title of sail-fish by the Dutch. It sometimes attains to so great a size as to have been compared to a small whale. When swimming near the surface, its dorsal fin may be seen projecting, from the distance of a league at sea. Many years ago a letter was addressed to Sir Joseph Banks by the captain of an East Indiaman, containing an account of the astonishing strength occasionally exerted by this species. The bottom of the ship was pierced through by it in such a manner that the snout or sword was buried almost to its base, and the animal itself was killed by the violence of the blow. Accidents of a similar nature have also occurred with the common sword-fish; and it is the opinion of naturalists that both species mistake our wooden walls for the vast abdomen of some great cetaceous animal which they desire to encounter and destroy.

We here figure, under the name of *Histiophorus pulchellus*, a beautiful dwarf species taken by M. Raynaud on his return from the Cape to France in 1829. It measured only four inches in length, and possesses certain special characters, which lead to the conclusion that, notwithstanding its minute size, it ought not to be regarded as the young of any previously described species. See Plate CCCII. fig. 11.

We now enter upon a group of genera which form the Second Great Tribe of Scomberidæ, and are characterised by having the *spiny rays of the back not continuous, but separate.*

The Scomberidæ, as has been already remarked, have the caudal fin in general very strong, although the other vertical fins are often extremely feeble. We have now noticed

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[1] Captain Crow, in a work recently published, relates the following spectacle, witnessed during a voyage to Memel. "One morning, during a calm, when near the Hebrides, all hands were called up at three A. M. to witness a battle between several of the fish called thrashers, or fox-sharks (*Carcharius vulpes*), and some sword-fish on one side, and an enormous whale on the other. It was in the middle of summer, and the weather being clear, and the fish close to the vessel, we had a fine opportunity of witnessing the contest. As soon as the whale's back appeared above the water, the thrashers, springing several yards into the air, descended with great violence upon the object of their rancour, and inflicted upon him the most severe slaps with their long tails, the sound of which resembled the reports of muskets fired at a distance. The sword-fish, in their turn, attacked the distressed whale, stabbing from below; and thus beset on all sides, and wounded, when the poor creature appeared, the water around him was dyed with blood. In this manner they continued tormenting and wounding him for many hours, until we lost sight of him; and I have no doubt they in the end completed his destruction." (Quoted from Mr Yarrell's *British Fishes*, p. 144.)

[2] It was probably this disparity of the dorsal fin in different individuals that induced Dr Leach to apply the new name of *Xiphias Rondeletii* to the old species. (See *Wernerian Memoirs*, vol. ii. part i. p. 58.)

[3] *Caratteri di alcuni nuovi generi*, &c. *della Sicilia*, p. 54.

[4] *General Zoology*, vol. iv. part i. p. 104, pl. 16.

the genera of the first great tribe, in which the posterior portion of the second dorsal and of the anal fin possess no continuous membrane between its rays, which thus remain free and disconnected, under the name of finlets. But in the group which we are about to enter it is the anterior dorsal which wants the membrane, and of which the rays are consequently free, and capable of isolated movement. Certain species even conjoin with this character that of the preceding tribe, and have finlets behind, at the same time that they possess free rays upon their anterior portion.

GENUS NAUCRATES, Rafin. Dorsal spines free; body fusiform; a carina or keel on the sides of the tail, as in the tunny, and two free spines before the anal fin.

This genus contains *N. ductor*, the famous *pilot-fish* of navigators (*Gasterosteus ductor*, Linn.), so named from its habit of keeping company with ships at sea, and frequently swimming beneath their bows. It would seem, from early indications of a similar instinct, to be the *Pompilius* of the ancients, described as pointing out the way to dubious or embarrassed sailors, and as announcing the vicinity of land by its sudden disappearance. It was thus regarded as a sacred fish. The other story of its serving as a guide to the shark does not appear to have been transmitted to us from so remote a source. It is not mentioned even by the Ichthyologists of the sixteenth century; and Cuvier regards as the first allusion to it, that of Dutertre in his *Description of the Antilles*, printed in 1667. Since that period it has been carefully repeated by all voyagers and compilers; and Osbeck even makes it a subject of pious reflection on the wonderful ways of Providence. We are told by a greater than Osbeck that "they that go down to the sea in ships, that do business in great waters; these see the works of the Lord, and his wonders in the deep:" but the fact in the present instance seems reducible to this, that the pilot accompanies both ships and sharks, sometimes swimming before, sometimes behind, for the sake of preying upon whatever may be thrown over board in the one case, or left uneaten in the other. It is true that the shark never attacks it; but it is also true that the hawk does not attack the swallow; and in both instances the reason is the same; the pilot being too nimble for the unwieldy shark in the water, just as the feebler but more agile bird is too swift in its movements for *falco* in the air. It is thus that the apparent alliance of these dissimilar fishes may be explained even upon general principles, to say nothing of Bosc's observation, who assures us that he has seen hundreds of pilot-fish, that they always keep at a respectful distance from the shark, and swim about swiftly in different directions, that they may more certainly avoid it. If any food be thrown over board, the pilot stops to seize it, and abandons both the shark and vessel. Geoffroy no doubt tells a story of two pilot-fish having been seen to take a great deal of trouble, swimming to and fro, in order to conduct a shark towards a *baited* hook; but admitting the truth of the details, it is clear, that whatever advantage might eventually accrue to the conductors, the probable result to the shark was a cruel death, and one is consequently the more inclined to admire how the narrative itself should find place in a Memoir *Sur l'affection mutuelle* des quelques animaux![1]

The pilot-fish in question is chiefly a Mediterranean species, although it also spreads into distant oceans, having been found by Daldorf under the equator. A great extent of geographical distribution may indeed be expected in reference to a species which is said to suffer itself to be led away immense distances in its eager pursuit of ships. Dutertre records that he saw one which followed his vessel for more than 500 leagues. Whether he kept his eye upon it night and day during all that time, or in what other way he ascertained it to be the same individual throughout so long a traverse, is what he does not state, and we therefore cannot explain. "In the year 1831," Mr Yarrell observes, "two specimens of pilot-fish were caught on the opposite side of the British Channel, and more than one instance has occurred of their following ships into Guernsey. A few years since, a pair accompanied a ship from the Mediterranean into Falmouth, and were both taken with a net. In January 1831, the Peru, Graham master, put into Plymouth, on her voyage from Alexandria for London, after a passage of eighty-two days. About two days after she left Alexandria, two pilot-fish, *Gasterosteus ductor*, made their appearance close alongside the vessel, were constantly seen near her during the homeward voyage, and followed her into Plymouth. After she came to an anchor in Catwater, their attachment appeared to have increased; they kept constant guard to the vessel, and made themselves so familiar, that one of them was actually captured by a gentleman in a boat alongside, but, by a strong effort, it escaped from his grasp, and regained the water. After this the two fish separated; but they were both taken the same evening, and, when dressed the next day, were found to be excellent eating. In October 1833 nearly one hundred pilot-fish accompanied a vessel from Sicily into Catwater, but they were not taken."[2] The pilot-fish is of a silvery blue colour, paler below, with

[1] *Annales du Mus. d'Hist. Nat.* t. ix. p. 469. In further illustration of the subject, we shall subjoin a short extract from a recent publication, Dr Meyen's *Reise um die Erde.* "The pilot swims constantly in front of the shark; we ourselves have seen three instances in which the shark was led by the pilot. When the sea-angel neared the ship, the pilot swam close to the snout, or near one of the breast fins of the animal; sometimes he darted rapidly forwards or sidewards, as if looking for something, and constantly went back again to the shark. When we threw overboard a piece of bacon fastened on a great hook, the shark was about twenty paces from the ship. With the quickness of lightning the pilot came up, smelt at the dainty, and instantly swam back again to the shark, swimming many times round his snout, and splashing, as if to give him exact information as to the bacon. The shark now began to put himself in motion, the pilot showing him the way, and in a moment he was fast upon the hook. Once we watched a pilot for many days, who kept constantly swimming close before the keel of the ship. The sailors say, as of a thing well known and familiar, that such a fish so situated has lost his shark, and is seeking another. Upon a later occasion, we observed two pilots in sedulous attendance on a blue shark, which we caught in the Chinese Sea. It seems probable that the pilot feeds on the shark's excrements, keeps his company for that purpose, and directs his operations solely from this selfish view." On this very singular subject we are tempted to quote another anecdote, which, notwithstanding what we have said in the text above, if correctly observed and recorded, would certainly indicate something remarkable in the association of these species. The account was furnished to the editor of the English edition of the *Animal Kingdom* (vol. x. p. 636), by Colonel Hamilton Smith, an accurate and accomplished naturalist. "Captain Richards, R. N., during his last station in the Mediterranean, saw on a fine day a blue shark, which followed the ship, attracted perhaps by a corpse which had been committed to the waves. After some time a shark-hook, baited with pork, was flung out. The shark, attended by four pilot-fish, *Scomber ductor*, repeatedly approached the bait; and every time that he did so, one of the pilots, preceding him, was distinctly seen from the taffrail of the ship to run his snout against the side of the shark's head, to turn it away. After some farther play, the fish swam off in the wake of the vessel, his dorsal fin being long distinctly visible above the water. When he had gone, however, a considerable distance, he suddenly turned round, darted after the vessel, and before the pilot-fish could overtake him and interpose, snapped at the bait and was taken. In hoisting him up, one of the pilots was observed to cling to his side until he was half above water, when it fell off. All the pilot fishes then swam about awhile, as if in search of their friend, with every apparent mark of anxiety and distress, and afterwards darted suddenly down into the depths of the sea. Colonel H. Smith has himself witnessed, with intense curiosity, an event in all respects precisely similar."

[2] *British Fishes*, p. 151.

bands of deeper blue upon the upper portions. It varies from four inches to a foot in length, and the larger individuals have much the aspect of a mackerel. The name of *pilot* has been bestowed on various other fishes, and the genus Naucrates itself contains several species. *N. Indicus*, Cuv. was brought from Amboyna by Messrs Lesson and Garnot.

Other genera of this tribe are ELACATE, LICHIA, CHORINEMUS, and TRACHINOTUS, which we cannot here do more than name.

GENUS RHINCHOBDELLA, Bl. and Schn. Free spines on the back, as in the preceding genera, and two free spines in front of the anal fin, but the ventrals are absent, as in *Xiphias proper*. The body is lengthened.

Of this genus Cuvier has formed two minor groups,—RHINCHOBDELLA (*Macrognathus*, Lacép.), including such species as have the muzzle concave, and striated beneath, and the three vertical fins separate; and MASTACOMBLUS, Gronovius, containing such as have the muzzle simply conical, neither striated nor concave, and the vertical fins more or less completely joined.

The species of both genera inhabit the fresh waters of Asia, and are widely distributed, from Syria to the isles of Sunda, the Moluccas, and China. Their snouts are furnished with a delicate organ of touch, and it appears that they employ it while searching in the mud for small worms, or other slender substances on whieh they feed. They are generally regarded as *poissons de bon gout*, the flavour of their flesh bearing some resemblance to that of eels.

The genus NOTOCANTHUS (of which *N. Nasus* is the sole species) is characteristic of the most northern seas.

We next proceed to a group of the Scomberidæ which forms the THIRD GREAT TRIBE, distinguished by having *the sides furnished with a cuirassed lateral line.*

In the tunnies, sword-fish, and other Scomberidæ already discussed, a projecting cartilaginous portion is observable, forming a kind of ridge or keel on each side of the tail, at the extremity of the lateral line. In the genera of the same family of which we have now to treat, this ridge is no longer a simple prominence of the dermis, but is covered by scaly shields, themselves crested, and overlapping each other. These shields, frequently ending in a point or hook, are not always confined to the termination of the lateral line, but sometimes spread over its entire length, and usually occupy a considerable portion. In relation to this character, however, the tribe may be divided into two sections: the first of which, comprising only the great genus *Caranx*, exhibits this kind of armour in its greatest strength and extension; while the second (of which the genus *Vomer* is the type) shows its gradual reduction to small scales, not surpassing those of the rest of the body.

GENUS CARANX, Cuv. Lateral line armed to a greater or less extent with scaly shields, raised into a keel, and pointed.

As an example, we here figure the *Caranx boops*, a beautiful fish from Amboyna, of a fine silvery hue, tinted towards the back with brilliant steel blue, with green reflections. A pure line of orange extends from the gills to the tail, but this ornamental character is said to disappear speedily after death. The pectoral fins are likewise orange. It varies from a few inches to a foot in length. See Plate CCCII. fig. 12. The genus is extremely numerous, containing probably not fewer than seventy different kinds; but the only other species we shall here notice is a fish called the *scad*, or horse-mackerel (*Caranx trachurus*, Lacép. and Cuv.), which occasionally occurs in prodigious shoals along the British shores. Ten thousand have been taken by a foot-sean in a single evening in August. It likewise occurs in the Mediterranean, and in the vicinity of Madeira.

Of genera allied to CARANX, and consisting chiefly of species heretofore and erroneously referred to ZEUS, Baron Cuvier has established or retained the following, viz. OLISTUS, SCYRIS, BLEPHARIS, GALLICHTYS, ARGYREYOSUS, VOMER, and HYNNIS. Of these our restricted limits prevent our exhibiting the detailed characters. We shall merely present the reader with a figure of that singular little fish *Gallichtys Ægyptiacus*, brought by Ehrenberg from the neighbourhood of Alexandria. It measures only from one to two inches in length, and is of a truly remarkable form. See Plate CCCIII. fig. 1.

We have now arrived at the concluding group or FOURTH GREAT TRIBE of the Scomberidæ, in which *the finlets, the free spines of the back, and the armour of the sides of the tail, are all wanting.*

The genera of this tribe, it will be perceived, are combined by means of merely negative characters, and it may therefore be expected that they will exhibit mutual relations of a less intimate kind than those of the preceding tribes. They form in fact a group, as it were, by continuity,—one of those series of which there are many in nature, and of which the agreement is not the less evident and harmonious, although it may be difficult to point out a precise character in common.

As we have little to say of general interest regarding their history or habits, we think it more suitable to the nature of this article to reserve a principal portion of our allotted space for the elucidation of those species concerning which some important or amusing information has been recorded. We shall therefore do little more than name the genera of our present tribe.

The genus SERIOLA scarcely differs from *Caranx*, except in the lateral line being either unprovided with a cuirass, or at least merely furnished with scales which slightly surpass those of the rest of the body. *S. Dumerilii* of Risso occurs near Nice, and elsewhere in the Mediterranean. It sometimes attains to the great weight of nearly 200 pounds, and dwells in deep and inaccessible places of the sea, rarely approaching the shores, unless when compelled to do so by hunger. Its flesh is of a reddish colour, firm, and of an exquisite flavour.

The genus TEMNODON greatly resembles the preceding, but its teeth are cutting. There are two small spines in advance of the anal fin, but almost concealed beneath the skin. We here place the *Perca saltatrix* of Linn. called *skip-jack* by the Americans. Its geographical distribution is extremely extensive.

The genus NOMEUS, Cuv. was for a long time combined with the Gobies. It is related in several particulars to *Seriola*, but the very large broad ventrals, attached to the body by their inner edge, produce a peculiar character and aspect. We here figure a small species, of which the ground colour is like brilliant silver. The ventrals are traversed by two black bands. It was transmitted to the Museum of the Low Countries from Java, by MM. Kuhl and Van Hasselt. See Plate CCCIII. fig. 4. Three other genera are described by Cuvier in this portion of his great work,[1] which, however, we shall merely name,—viz. NAUCLERUS, PORTHONEUS, and PSENES. The next genus is of more general interest.

GENUS CORYPHÆNA, Linn. Body compressed, elongated, covered by small scales; head compressed, profile circular; eyes low, approaching the angle of the mouth; dorsal fin rising from the cranium, and stretching con-

[1] *Hist. Nat. des Poissons*, t. ix. pp. 247-67.

tinuously to the tail, towards which it decreases in elevation.

This noted genus has been remodelled in recent times, and now consists of the following minor groups.

1*st.* Genus Coryphæna proper. Cuv. Head very elevated, profile curved and perpendicular, eyes low; mouth well cleft; teeth like those of a wool card.

The generic term is derived from κορυφη, *vertex*, or top of the head, in reference to the height of the crest of the cranium. This division contains the famous *dolphin* of the Mediterranean (*Cor. hippurus*, Linn.), so celebrated for the beauty of its versatile tints.

> .... parting day
> Dies like the dolphin, whom each pang imbues
> With a new colour as it gasps away,
> The last still loveliest, till—'tis gone—and all is gray.

The species are still in some measure indistinctly characterized. They occur in the Pacific and Atlantic Oceans, and the Mediterranean Sea, and are remarkable, among other things, for their keen pursuit of flying fish, which, in the first place, they force to leave their native element, and then following swiftly in a corresponding track, receive with open mouth the moment they descend exhausted to the surface. The Coryphænæ may be regarded as among the most brilliant inhabitants of the sea. It is necessary, according to Bosc, to have seen them following a vessel in troops, before we can form a proper estimate of their beauty. When they swim embodied near the surface, and beneath the light of a cloudless sky, they seem effulgent with the richest gold, combined with the sparkling lustre of the topaz, the emerald, and the sapphire,—and every brilliant hue in perpetual change, accordant with the vivacity and varied grace of their movements. It is indeed a spectacle sufficient anywhere to excite our unfeigned admiration; and when seen suddenly amid the waves of the lonely and monotonous ocean, it comes upon us like a glad surprise. The beauty of these fishes has in every age attracted the wonder

> Of all who on the wide deep wandering are;

and it is so far to be regretted, that their fugitive colours have been the chief object of attention,—their more precise description and specific discrimination having been greatly disregarded.

The Coryphænæ are strong, active, and voracious fishes. While swimming rapidly, they seem rather as if impelled or projected forwards by some exterior force, than by any exertion of their own. But, on attentive examination, a strong and rapid muscular movement may be detected, by the constant undulation of the long dorsal fin, a movement which greatly contributes to the throwing off of those lustrous metallic reflections for which they have so long been noted. The Mediterranean species, *Cor. hippurus*, if not the most beautiful, is the largest known. It sometimes attains to the length of five feet. Its colours, so far as they are capable of description, are silvery blue above, with markings of a deeper azure, and reflections of pure gold—the lower parts citron yellow, marked with pale blue. The pectoral fins are partly lead colour, partly yellow; the ventrals are yellow on their under surface, and black above; the anal fin is yellow. The iris of the eye is made of apparent gold.[1]

One or two other kinds, not so distinctly known, occur in the Mediterranean, and many others in more distant seas. We here figure a large species, measuring nearly four feet in length, taken by M. Dussumier about fifty leagues to the west of the Azores, for which reason it bears the name of *Coryphæna Azorica*, see Plate CCCIII. fig. 2. The Portuguese name more than one species *Dorade*, a term which, from its similarity to *Daurade* (a frequent appellation of our gilt-head, *Chrysophris aurata*), has produced some confusion. Not less ambiguous is the name of *Dolphin*, which appears to have been first misapplied to the Coryphænæ by the Dutch. It is scarcely necessary to observe, that the English word Dolphin, as synonymous with the Greek Δελφις, the Latin Delphinus, and the French Dauphin, was originally, and is still correctly, applied only to designate a group of cetaceous animals (allied in structure to the whales), to which the classical dolphin of antiquity assuredly belonged. But by some conversion, into the history of which it is not worth while to inquire, the term has been applied by most modern writers, particularly poets, to a creature of another class, a genuine fish, of the genus *Coryphæna*. No fault therefore can be imputed to the naturalist, if the general misapplication of the term is now found to occasion any misconception. There is no doubt, however, that the animal beloved by gods and men, the *Hieros Ichthys* of the heroic Greeks, and the revered symbol of the *Delphic* Apollo, was nothing more than a pellock or porpoise.[2]

2*d.* Genus Lampugus,[3] Cuv. Head oblong; central crest of the forehead much lower than in Coryphæna; dorsal fin equal, and low throughout its whole extent.

More than one species occurs in the Mediterranean, but the most common in that sea is *L. pelagicus*, which almost in every thing resembles the so-called dolphin, except in the form of its head, and more diminutive dimensions.

3*d.* Genus Centrolophus, Lacép. Form more lengthened; palatine teeth wanting; an interval between the occiput and the commencement of the dorsal fin.

Most of the species occur in the Mediterranean; and the *black perch* of Pennant, the *black fish* of Couch and Yarrell (*Cent. pompilus*, Cuv.), is referrible to this genus. It is a fish of great strength and velocity, measuring from two to three feet, and is one of our rare British species.

Genus Astrodermus, Bonelli. Head elevated and sharp; mouth slightly cleft; only four branchial rays; ventrals very small, and placed upon the throat; scales scattered upon the body, and assuming the radiated form of little stars. It is from the latter circumstance that the genus derives its name.

There is only a single species of this genus,—recently discovered, and still extremely rare. It has been taken near Nice, and also in the Gulf of Cagliari in Sardinia, and was originally described by M. Risso under the name of *Coryphæna elegans*.

Genus Pteraclis. Head and teeth as in *Coryphæna*, but the scales are larger, the ventrals very small, and placed upon the throat; the dorsal and anal fins prodigiously extended.

This eccentric genus is founded on a fish described by Pallas in his *Spicilegia*, under the name of *Coryphæna ve-*

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[1] Every voyager seems to describe the dolphin in his own way; and it is by no means easy for a landsman to ascertain which is the right one. The play of colour, as it is called, may no doubt admit of great diversity in the expressions used. The above description is from the recorded observation of the living fish by M. Biberon. Another eye-witness, Colonel Bory St Vincent, describes the back as being of a sea-green colour, sprinkled with orange spots; the abdomen silvery; the lateral line yellow; the dorsal fin celestial blue, with golden-coloured rays; the caudal fin surrounded by a green hue; the other fins yellow. (*Dictionnaire Classique d'Hist. Nat.* t. iv. p. 528.)

[2] Wilson's *Illustrations of Zoology*, vol. i. article Delphinapterus.

[3] Synonymous with the genus *Caranxomus* of Lacépède, which was adopted by Cuvier in the *Règne Animal*, but is now, so far as the name is concerned, handed over to oblivion.

Acanthopterygii. Scomberidæ.

lifera, and it was with a feeling of doubt that Cuvier placed it where it now stands. It is not easy to conceive the use of its dorsal and anal fins, so enormously large in proportion to the size of the body. Pallas indeed imagined that they might serve to sustain it in the air; but in that case the fish must fly, as a flounder swims, upon its side. The species are unfortunately so rare, that it may be long before an opportunity occurs of throwing any light upon the subject. The only known specimen of *Pt. ocellatus*, Cuv. was taken entire from the stomach of a bonito in the Straits of Mosambique. The species represented in this work (See Plate CCCIII. fig 3) was brought to Europe by MM. Quoy and Gaymard, but we know not from what locality.

Genus Stromateus, Linn. Distinguished among the Scomberidæ by the want of the ventral fins, and by a single dorsal, the spiny rays of which, few in number, are concealed in its anterior margin. The vertical fins are covered by scales, as among the Squammipennes.

The Mediterranean produces a beautiful species (*St. fiatola*, Linn.), remarkable for its spots and broken bands of gold upon a lead-coloured ground. The *black pomfret* of India, a delicious fish for table uses, pertains to this genus. It is the *St. niger* of Bloch. According to Russel, it is abundant at Vizagapatam during the months of March and April, and vanishes and re-appears alternately every two or three days. It requires to be eaten immediately after capture.[1] A singular circumstance in the geographical history of this genus is, that although the species seem common along a great extent of Indian coast, and spread as far as China, none is known at the Isle of France, nor in any part of the Indian Archipelago.

Genus Rhombus,[1] Lacép. Extremity of the pelvis forming, anterior to the anus, a small pointed and cutting blade, which resembles a vestige of the ventral fins.

As an example, we may mention the *Harvest fish* of New York, an excellent article for the table. It is the *Rh. longipinnis* of Cuvier, erroneously placed by Linnæus among the Chætodons.

The genus Luvarus of Rafinesque resembles the preceding. There is only one species distinctly known (*L. imperialis*), a fish of fine flavour, but extremely rare. It measures five feet in length; the whole body is of a reddish silvery colour, more obscure upon the back. It was dashed ashore near Solanto, in Sicily.[2] A species unknown to the fishermen was taken in 1826, at Isle-de-Ré, which Cuvier regards as referrible to this genus. The genus Seserinus, Cuv. possesses the characters of Stromateus, but very small ventrals are perceptible, or at least the vestiges of these organs are apparent. The only known species is *S. Rondeletii*, a small fish of the Mediterranean.

Genus Kurtus, Bloch. Allied to Rhombus, but differs in the dorsal fin being shorter, and the ventrals more developed. The scales are so fine as to be imperceptible in the dried state. There are seven branchial rays. The pelvis shows a spine between the ventrals, and several small cutting blades are visible anterior to the dorsal fin, at the base of which is a spine directed horizontally forwards.

The skeleton in this genus presents a striking peculiarity in the ribs, which are dilated, convex, and in the form of rings which come in contact with each other,—thus enclosing a conical empty space, which is prolonged beneath the tail, in the inferior rings of the vertebræ, into a long thin tube enclosing the swimming bladder. The species inhabit the Indian seas, and are few in number. *K. cornutus*, called *somdrum-hara-moddee* at Vizagapatam, and which Cuvier regards as the male of *K. Blochii*, Lacépède, is an excellent eating fish, remarkable for being almost transparent in a state of freshness.

We shall conclude our exposition of the Scomberidæ by a brief notice of the genus Zeus, Linn. from which some of the preceding genera, such as *Gallychtis*, *Argyreyosus*, &c. have already been detached. In its more restricted form it contains fishes of a compressed body, protractile mouth covered by small scales, with teeth feeble and few in number. It is further divisible as follows:

Genus Zeus, Cuv. Dorsal fin emarginate, its spines accompanied by long slips of the membrane; a series of forked spines along the base of the dorsal and anal fins.

The type of the genus is *Zeus faber*, commonly called the *Dory* (Plate CCCIII. fig. 5), probably from the French term *dorée*, in allusion to the golden tints of its body.[3] Its surface has at the same time a smoked appearance, on which account the French name it *forgeron*, a word which corresponds to the Latin trivial name of *faber*, or blacksmith. It is also called the *fish of St Peter*, from an ancient traditionary belief that it was from the mouth of this species that the apostle extracted the tribute-money, and the black spot on either side of its body is supposed to be a record of its capture at that time.[4] The dory is a fish greatly esteemed for the table. It occurs both in the Mediterranean Sea, and along the oceanic coasts of Europe. According to Pennant, the largest are found in the Bay of Biscay. Willughby alludes to it as common in his day on the shores of Cornwall; and it is still taken both there and along the Devonshire coast, occasionally even in profusion. Mr Couch, as quoted by Mr Yarrell, considers the dory rather as a wandering than a migratory fish, and as regulated in a great measure by the movements of the smaller kinds on which it preys. When the pilchards approach the shore, it is frequently taken in considerable numbers. In the autumn of 1829, more than sixty were hauled on shore at once in a net, some of them of large size, and yet the whole were sold together for nine shillings. The largest specimens of the London market weigh from ten to twelve pounds, but the average weight is scarcely more than five. The dory is a bold, voracious species, preying greedily upon the more timid kinds, and pouncing readily upon all sorts of bait. Its flesh was highly esteemed in the time of Pliny. Columella, who was a native of Cadiz (where it was regarded as the best of fishes), has recorded that it had been long known by the name of *Zeus*—a designation which in

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[1] In the second edition of the *Règne Animal*, this genus bears the name of Peprilus; Cuvier not having been at that time aware that it had been previously designated by Lacépède under the name of *Rhombus*. We deem the choice of the latter name equally unfortunate, seeing that it had been previously applied generically to that group of the Pleuronectidæ called *Turbots*. But we leave it to more influential authors to propose a second change.

[2] Rafinesque, *Caratteri di alcuni nuovi generi*, &c. *della Sicilia*, p. 22.

[3] A variety of derivations, however, have been assigned to the English name. In addition to the one above alluded to, we shall merely mention the following: St Christopher, while wading through an arm of the sea, and bearing the infant Saviour, is said to have caught a dory, and to have impressed its sides with the two peculiar marks, as a perpetual record of the fact. The name was therefore said to be from the French *adorée*, worshipped, as something unusually sacred. The designation of *John Dory* is in all probability derived from the French *jaune dorée*, in allusion to the tints of a *golden yellow* hue with which it is adorned. Some, however, refer it (and again in connection with St Peter) to the Italian term *janitore*, or door-keeper, by which it seems the species is known to the fishermen of the Adriatic.

[4] The common haddock also bears a share in this tradition.

itself argues pre-eminence, Ζευς in Greek signifying the monarch of the gods.

Genus Capros, Lacép. Dorsal fin emarginate, as in the preceding, and the mouth still more protractile; but there are no spines to either the anal or dorsal fin. The body is covered with strong rough scales.

The only species with which we are acquainted is the *Zeus aper* of Linn. a small fish of the Mediterranean. A specimen was taken in Mounts Bay in October 1825,[1] and more recently it was observed in the Bridgewater fish-market, as we are informed by W. C. Trevelyan, Esq.

Genus Lampris, Retzius. A single dorsal fin, high in front, where it is furnished with one or two small spines. The ventrals have ten long rays, and the lobes of the caudal fin are considerably elongated, but these prolongations seem to become effaced by age. The sides of the tail are carinated.

The only known species (*L. guttatus, Zeus luna*, Gmelin) occurs, though rarely, off the French coasts, and in the British seas, where it is known as the *opah* or king-fish. It is one of the most splendid and remarkable of European fishes. Its back is of a deep blue spotted with silver,—the rest of its body like polished gold, reflecting all the colours of the rainbow. It is certainly sufficiently singular that a species included by Nilsson in his *Prodromus* of the fishes of Scandinavia, should likewise be enumerated by Kæmpfer as occurring in Japan. The opah is a fish of great size, measuring sometimes five feet in length. Its flesh is said to taste like beef. See Plate CCCIII. fig. 6.

The remaining genera are Equula, Cuvier, and Mene, Lacépède. The *Zeus insidiator* is an example of the former,—the *Zeus maculatus*, of the latter.

FAMILY VIII.—TÆNIOIDÆ.

This family is closely connected with the Scomberidæ. The species are of a very lengthened form, and flattened laterally, from which they have obtained the name of ribbon-fishes. Their scales are very small.

The first tribe[2] comprehends those genera of which the mouth is small, and but slightly cleft.

Genus Gymnetrus, Bloch. Body elongated and flat; anal fin entirely wanting; dorsal fin long, with prolonged anterior rays, which, however, are easily broken; ventrals also very long, when not worn away by use, or otherwise fractured; the caudal, composed of few rays, rises vertically on the extremity of the tail, which finishes in a little hook. There are six branchial rays.

The species are so soft and tender that they often present themselves as it were with false characters, from the natural mutilation of the rays. For this reason they are as yet indistinctly characterized by systematic writers. Even the central skeleton, and especially the bones of the vertebræ, are extremely soft. The stomach is long; there are numerous cæca; the swimming bladder is wanting; and the flesh, of a mucous nature, decomposes with great rapidity. The European species occur in the Mediterranean, and also occasionally in the British and more northern seas. The fish called *king of the herrings* by the Norwegians belongs to this genus. We here figure as a curious example the *Gymnetrus falx*. See Plate CCCIII. fig. 8. We may add, that the *Gymnetrus Hawkenii* of Bloch, a species originally described from a specimen taken near Goa, in the Indian Sea, was many years ago drawn ashore dead on the south coast of Cornwall. It measured nearly nine feet, and weighed forty pounds. The *vaagmaer*, or *deal-fish*, has also been recorded by Dr Fleming as a British species.[3] It is the *Gymnetrus Arcticus* of systematic authors.

That very singularly-formed fish, the *Stylephorus cordatus* of Shaw, forms the remaining genus of the present tribe.[4]

In the second tribe of Tænioidæ the muzzle is short, and the mouth obliquely cleft.

Genus Cepola, Linn. Dorsal and anal fin long, each reaching to the base of the caudal, which itself is rather large; the cranium is not raised or crested; the muzzle is very short, with the superior curved upwards; the teeth are distinct, and the ventral fins perceptibly developed. There are a few unarticulated rays in the dorsal fin, which are as flexible as the others; the spine of the ventrals alone being stiff and pointed. There are six branchial rays. Both the abdominal cavity and stomach are very short. Some cæca are perceptible, and a swimming bladder, which extends into the caudal extremity. The occasional occurrence of a Mediterranean species of this genus (*Cep. rubescens*, Linn.) along the coasts of Devon and Cornwall has been recorded both by Montagu and Couch.[5]

Genus Lophotes, Giorna. Head short, surmounted by a raised osseous crest, on the summit of which is articulated a long and powerful spiny ray, bordered behind by a membrane, and followed by a low simply rayed continuous fin, which spreads onwards to the point of the tail. Caudal fin distinct but small; and beneath the abovementioned point there are two scarcely perceptible ventral fins furnished with four or five exceedingly small rays. The teeth are pointed, and not very close together; the mouth directed upwards, and the eyes very large. There are six branchial rays, and the abdominal cavity occupies almost the entire extent of the body. We are acquainted with only a single species (*Loph. Lacepedianus*), which inhabits the Mediterranean, where, however, it is extremely rare. It attains to a large size, that is, to about four feet in length.[6]

FAMILY IX.—THEUTIDÆ.

This family is perhaps as closely allied to the Scomberidæ as the preceding, but its alliance proceeds from other points,—such as the armature of the sides of the tail in several genera, or the horizontal spine anterior to the dorsal fin in others. It comprises but a small number of foreign genera, with compressed oblong bodies, small mouths, slightly or not at all protractile, armed on each jaw with cutting teeth upon a single range, the palate and tongue without teeth, and a single dorsal fin. The species are of herbivorous habits, feeding chiefly on fuci and other marine vegetation. Their intestines are ample. We are compelled to be brief in our indications of the generic groups.

The genus Siganus, Forsk. of which the species are

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[1] *Proceedings of the Zoological Society*, 1833, p. 113.

[2] In the *Règne Animal*, t. ii. p. 217, the first tribe of the family above named is composed of the genera *Lepidopus* and *Trichiurus*, which, however, in Cuvier's later work (*Hist. Nat. des Poissons*, t. viii. p. 217) are placed as an appendix to the first tribe of the Scomberidæ, where we have accordingly placed them in the present article. We therefore commence the Tænioidæ with what was formerly the second tribe.

[3] *Magazine of Nat. Hist.* vol. iv. p. 215.

[4] See *General Zoology*, vol. iv. part i. p. 87.

[5] *Linn. Trans.* vol. vii. p. 291, and vol. xiv. p. 17.

[6] See *Mem. de l'Acad. de Turin*, 1805-8, p. 19; and *Ann. du Museum*, t. xx. fig. 17.

numerous in the Indian seas, is characterized by a feature believed to be unique among fishes, that of having both the outer and inner ray of the ventral fins spiny. The genus ACANTHURUS, Bloch, has the teeth cutting and dentated, and a strong moveable spine on each side of the tail, capable of inflicting a severe wound on those who grasp it incautiously. On this account a species greatly sought for in the West Indies as food has received the name of surgeon, *Ac. Chirurgus.* As an example we here figure the *Acanthurus Delisianus.* See Plate CCCIII. fig. 7. In the genus NASEUS the sides of the tail are armed with fixed spines, and the teeth are conical. The great peculiarity, however, consists in a horn-like prominence on the front of the head. The skin resembles leather. Forskall relates of one species (*N. fronticornis,* Lac.) that although of peaceable demeanour and herbivorous habits, it knows how to defend itself from unprovoked aggression; and he reports the observations of some Arabian fishermen, who saw a troop of them come to the rescue of a companion who had been transfixed on the surface of the water by an eagle. They so bothered the "Bird of Jove" as eventually to produce his death by drowning. This, however, savours more of an "Arabian Tale" than of a fact in natural history. See Plate CCCIII. fig. 9. The reader will perceive in the two preceding representations a resemblance to the genus Chætodon. The remaining genera of this small family are AXINURUS and PRIODON, Cuv.

FAMILY X.—LABYRINTHIFORM PHARYNGEALS.

By this term Baron Cuvier means to designate the peculiar structure of a part of the upper pharyngeal bones, which are divided into leaflets more or less numerous and irregular. This formation produces cells capable of containing water, which flows upon and moistens the branchiæ for some time after the fish itself has been removed from its natural element; and this refreshing influence is rendered the more effectual by the closeness of the opercula or gill-covers. The consequence is, that most of the species possess the power of quitting their streams and pools, and creeping, as it were, to some little distance from their watery homes,—a faculty not unknown to ancient writers, and one which in India has led to the belief that these fishes fall from heaven.

GENUS ANABAS. In this genus the labyrinths alluded to attain the greatest degree of complication. Nevertheless the third pharyngeals have teeth *en pavés,* and there are others beneath the back of the cranium. The body is round, covered by strong scales; the head large; the muzzle short and obtuse; the mouth small; the lateral line interrupted about its posterior third. The margins of the opercle, sub-opercle, and inter-opercle, are strongly toothed, but not those of the pre-opercle. The branchial membrane has five rays. There are many spiny rays to the dorsal, and even to the anal fin. The stomach is of medium size, rounded. The pylorus has only three appendices.

The generic name is derived from the Greek, *αναβαινω, to ascend,* and refers to the singular instinct of the only known species (*An. scandens,* Plate CCCIII. fig. 11), which induces it to climb trees.[1] It performs this action by means of the spiny processes of the gill-covers, and moves at pleasure up the trunks of trees which grow by the water side. It was observed by Lieutenant Daldorff, at Tranquebar, ascending by a fissure in the stem of the palm called *Borassus flabellifer,* and was also found to be so tenacious of life as to move about upon the dry sand for some hours after it was captured on the tree.[2] At the same time other respectable observers who have attended to this species in its natural state, make no mention of the fact. M. Reinwardt has frequently taken the Anabas at Java, but never heard any climbing propensities attributed to it; M. Leschenault, who transmitted several specimens to Pondicherry, simply observes that they dwell in rivers and fresh-water ponds; while Mr Hamilton Buchanan proceeds still further, and not only denies the fact, but regards it as contrary to the laws of nature. One point, however, is certain, that it is capable of living an unusual length of time out of the water, a fact in perfect accordance with the peculiar structure of its pharyngeals. It also creeps about upon the ground for hours together, and the fishermen are alleged to keep it alive for five or six days in a dry vessel. It is thus brought alive to the markets of Calcutta from the great marshes of the district of Yazor, which are distant more than a hundred and fifty miles. "Les charlatans et jongleurs," says Cuvier, "dont l'Inde abonde, ont généralement de ces poissons avec eux dans des vases, pour amuser la populace de leurs mouvemens."[3]

Passing over the nearly allied genera of HELOSTOMA, POLYACANTHUS, COLISA, and MACROPODUS, we arrive at the

GENUS OSPHRONEMUS of Commerson, of which the forehead is somewhat concave, the anal fin larger than the dorsal, the sub-orbitals and base of the pre-opercle finely dentated, and the first soft ray of the ventrals remarkably prolonged. There are six branchial rays, and the general form of the body is much compressed.

This genus contains the *Os. olfax,* or *Gourami,* one of the most famous for its flavour of all the fishes of the East. See Plate CCCIII. fig. 10.) It grows as large as a turbot, and is even more delicious than that favourite food. Commerson has recorded in his manuscript that he never tasted so exquisite a fish,—"Nihil inter pisces tum marinos tum fluviatiles exquisitius unquam degustavi;" and he adds, that the Dutch of Batavia rear them in large earthen vessels, renewing the water every day, and feeding them on aquatic plants, particularly *Pistia natans.* That navigator was also of opinion that the species had been imported originally from China to the Isle of France, and it appears to have been recently conveyed to the French colonies in South America by Captain Philibert. Its importation to Europe would be well worth attempting, and would probably be attended by success if the Gourami, like the golden carp, is actually a native of China. It does not, however, appear that any mention is made of it in any natural history notices of that empire, and it seems as yet unknown in India. It is said that the female Gourami hollows out a little foss in the side of the pond where she is kept, for the purpose of depositing her eggs in safety.

The remaining genera of this group are TRICHOPUS, SPIROBRANCHUS, and OPHICEPHALUS. Of the former two only a single species is known of each. The last named is more numerous, and is deserving of a brief notice.

The *Ophicephali* resemble all the preceding genera of the family in the majority of their characters, and particularly in the cellular disposition of their pharyngeals, which seem equally adapted for the singular retention of water before alluded to. They can consequently also creep to a considerable distance from their liquid abodes; but what particularly distinguishes and even separates them from all

[1] It is synonymous with *Perca scandens* of Daldorf, and *Coius coboius* of Buchanan. In the Tamoul language it is called *Panciri,* or the *tree climber.*

[2] *Linn. Trans.* vol. iii. p. 62.

[3] *Hist. Nat. des Poissons,* t. vii. p. 332.

other acanthopterygian fishes, is the absence of spines to the fins, except the single one to the ventrals, which itself, though simple, is neither stiff nor pointed. The body is elongated, and almost cylindrical; the muzzle short and obtuse; the head depressed, and furnished with polygonal scales, or rather plates, as in *Anabas*. It may be said, however, that it is by means of the solitary ventral spines alone that they exhibit the normal character of the great division of acanthopterygian fishes with which we have been hitherto engaged. They thus, by such ambiguous combination of character, almost break up the grand distinction of acanthopterygian and malacopterygian species, a distinction otherwise so well grounded as to have hitherto produced no disruption of the relations of natural affinity. "If it were possible," says Cuvier, "to admit that anomalous beings existed in nature, there is certainly none to which the title is so justly due as to the Ophicephali." Their watery reservoirs enable them to journey from one marsh to another, and they are moreover so tenacious of life that their bowels may be torn out, and themselves cut to pieces, without producing immediate death. They are often thus carried about alive, or sold in the markets slice by slice; and the consumers refuse to give the best price when so much has been cut away that the remainder ceases to move. This seems a parallel case to that of the beef-steaks from the oxen of Abyssinia. We here figure as an example of this singular genus the *Ophicephalus striatus*, a species which seems spread over the whole of India. See Plate CCIII. fig. 12. Buchanan describes another species under the name of *Gachua* (*Oph. marginatus*, Cuv.?), which sometimes grows to a foot in length. It is very common in the ponds and fosses of Bengal, and is one of the species most generally believed to fall from the clouds in wet weather. During the first heavy showers of the rainy season, they are certainly seen crawling on the grass; but their object in so doing is doubtless to escape from the corrupted water of the narrow dykes which they had previously inhabited, and to go in search of a purer element, and a fresher and more ample food. The species called *Barca* by Buchanan lives in holes in the vertical banks of the Brahmapootra, with nothing visible but its head, that it may the more readily observe and seize its prey. It is a large fish, measuring three feet in length, and is regarded as good eating. On the whole, however, the species of this genus are consumed rather by natives than Europeans,—the latter probably regarding them too much in the light of reptiles. We may add, that the *Ophicephali* are often exhibited by the Indian jugglers, and that even the children amuse themselves by forcing them to crawl upon the ground.

FAMILY XI.—MUGILIDÆ.

The fishes which compose our present group (corresponding to the genus Mugil of Linn.) exhibit so many peculiarities of organization, that Cuvier has deemed it advisable to form them into a distinct family. The body is almost cylindrical, covered with large scales, and furnished with two distinct dorsal fins, the first of which has only four spiny rays. The ventrals are attached somewhat behind the pectorals. The gills have six rays. The head is rather depressed, also covered with large scales or polygonal plates. The muzzle is very short. The transverse mouth forms an angle by means of a prominence of the middle of the lower jaw, corresponding to a depression of the upper one; and the teeth are excessively fine, indeed in some cases imperceptible. The pharyngeal bones, greatly developed, give an angular form to the œsophagus resembling that of the mouth, which permits only fluids or very small substances to enter the stomach, notwithstanding which the latter terminates in a kind of fleshy gizzard, analogous to that of birds. The pyloric appendices are few in number, but the intestine is long and folded.

Acanthopterygii. Mugilidæ.

The species are excellent as articles of food. They resort in vast troops to the mouths of large rivers, where they may be observed continually springing out of the water.

The *Mugil cephalus*, or Mediterranean gray mullet (the English name must not mislead the unpractised reader to confound it with the genus *Mullus*, formerly described), is distinguished from all the other European species by its eyes, which are half covered by two adipose veils adherent to the anterior and posterior margin of the orbit, and by the peculiar concealment of the maxillary bone, which, when the mouth is closed, is completely hidden beneath the sub-orbital. The base of the pectoral fin is surmounted by a long carinated scale. See Plate CCCIII. fig. 13. The species just referred to is the best and largest of the Mediterranean kinds. It weighs about ten or twelve pounds, and does not appear to have been yet detected in the seas or estuaries of Britain, nor along the oceanic shores of France. It is very common on the coast of Spain, especially around the island of Ivica, where the fishermen are said to recognise two varieties under the names of *Mugil* and *Lissa*. When surrounded by a net, it endeavours, and often successfully, to effect its escape, by leaping over the edges into the unencumbered sea.[1]

"Its hearing is very fine, as has been noticed by Aristotle, and it feeds on worms and small marine animals; but it is doubtful, though it has been advanced, that it can live on vegetable substances. It appears to be of a stupid character, a fact which was known in the time of Pliny, for that author tells us that there is something ludicrous in the disposition of the mullets; for if they are afraid they conceal their heads, and thus imagine they are entirely withdrawn from the observation of their enemies.

"When, towards the end of spring and the commencement of summer, the fishes of this species, excited by the necessity of living in the fresh water, approach the shores and advance towards the mouths of the rivers, they form such numerous troops that the water through which they are seen, without being clearly distinguished, appears to be bluish. This particularly happens in the Garonne and the Loire at these periods. The fishermen there adopt the plan of surrounding these legions of mullets with nets, the enclosure of which they gradually contract, taking care to make a noise to frighten the fish, and oblige them to press together, and heap themselves as it were one upon the other.

"Of the mullets thus taken some are eaten fresh, others are salted and smoke-dried; it is with their eggs salted, washed, pressed, and dried, that the preparation called *botarcha* is made, which is a condiment greatly in request in Italy and the southern provinces of France. The flesh of this mullet is tender, delicate, and of an agreeable flavour; it is fatter and more in estimation when it is taken in the fresh water. The ancients, who from the time of Aristotle were acquainted with this fish, had it in great request; and the consumption of it is still very considerable in most of the southern countries of Europe. According to the report of Athenæus, those mullets were formerly in very high esteem which were taken in the neighbourhood of Sinope and Abdera; while, as Paulus Jovius informs us, those were very little prized which had lived in the salt marsh of Or-

[1] The *Mugil saliens* derives its specific name from the extraordinary velocity with which it springs into the air when it finds itself about to be enclosed.

bitello in Tuscany, in the lagunes of Ferrara and Venice, in those of Padua and Chiozza, and such as came from the neighbourhood of Commachio and Ravenna. All these places in fact are marshy, and the streams by which they are watered are brackish, and communicate to the fish which they support the odour and the flavour of the mud."[1]

At the conclusion of this family Cuvier places the two following genera, the first of which is allied partly to the mullets and partly to the Scomberidæ, while the second partakes of characters intermediate between the Mugilidæ in general, and the ensuing family of Gobioidæ.

Genus Tetragonurus, Risso, so called from two salient crests on each side, near the base of the caudal fin. The body is elongated; the spinous dorsal long, but very low,—the soft dorsal approximate, but higher and short, with an anal of corresponding form; the ventrals are a little behind the pectorals; the branches of the lower jaw are vertically raised, and furnished with a range of pointed cutting teeth, forming as it were a saw, and fitting, when the mouth is closed, into those of the upper jaw. The stomach is garnished interiorly with hard and pointed papillæ.

The only known species (*T. Cuvieri*, Risso) is found along the Mediterranean shores, but only at great depths. It is of a black colour, measuring about a foot in length, and is covered by hard, toothed, striated scales. Its flesh is said to be poisonous.

Genus Atherina, Linn. Body elongated; dorsals wide apart; ventrals further back than the pectorals; mouth very projectile, and furnished with extremely small teeth. The transverse processes of the last abdominal vertebræ are bent so as to form a little conical bag for the reception of the point of the swimming bladder.

All the known species are characterised by a broad silvery band along the sides. They are highly esteemed for their delicacy; and the fry, which continue for a long time together in crowded troops, are eaten along the Mediterranean shores under the name of *Nonnat*. *A. hepsetus*, Linn. was till very recently regarded as indigenous to the seas and estuaries of Britain. There was reason, however, to believe that several species had been confounded under that name; and Mr Yarrell has ascertained that the British species, commonly called the Atherine, coincides in its characters with the *Atherina presbyter* of Cuvier. It is a common fish at Brighton, where, under the name of *sand-smelt*, it is eaten in large quantities by the inhabitants and visitors during the winter months. It partakes of the cucumber smell and flavour of the true smelt, and is a small handsome fish, measuring from five to six inches. It is rarely brought to the London market. It spawns in May and June.

FAMILY XII.—GOBIOIDÆ.

This family derives its name from the Linnæan genus *Gobius*, and is distinguished by having the dorsal spines slender and flexible. The viscera of all the fishes pertaining to it are nearly of the same conformation; the intestinal canal is equal, ample, and without cæca, and there is no swimming bladder.

The species referrible to the genus *Blennius*, Linn. present a very distinctive character in having their ventral fins placed before the pectorals, and composed only of two rays. Their bodies are elongated and compressed, and they bear only a single dorsal, composed almost entirely of simple and flexible rays. They live in small companies in rocky streams, and can survive for a considerable time out of the water, in consequence of their skin being covered with a kind of mucus, a circumstance which has caused the Greek name *Blennius* to be applied to them. Many of them are viviparous, and both sexes have a tubercle near the anus, which seems to be subservient to the purposes of copulation. They are now arranged under the following genera:

Genus Blennius, Cuv. Includes the blennies properly so called, and is characterised by long, equal, and closely-placed teeth, forming only a single and rather regular row on each jaw, terminating behind in some species by a long and hooked tooth. The head is obtuse, the muzzle short, and the forehead vertical; the intestines broad and short. Several species occur along the coasts of Britain. Of these we may mention the butterfly blenny (*B. ocellaris*), distinguished by having the dorsal bi-lobed, the anterior lobe being very elevated, and marked with a round black spot, cinctured with a white and black circle. See Plate CCCIV. fig. 1.

Genus Myxodes, Cuv. Separated from the blennies properly so called, in consequence of the head being elongated, the snout pointed, and projecting beyond the mouth; the range of teeth like those of the blennies, but without the canine teeth.

Genus Salarias, Cuv. Teeth laterally compressed, hooked at the extremity, exceedingly slender, and in prodigious numbers. The head of these fishes is very much compressed superiorly, and of great breadth across the base: their lips are fleshy and thick, their forehead quite vertical, and their intestines, spirally convoluted, are longer and more slender than in the common blennies. All the known species are from the Indian Ocean.

Genus Clinus, Cuv. Teeth short and pointed, disposed in several rows, the first of which is largest. Their muzzle is less obtuse than in the two preceding groups, the stomach broader, and the intestines not so long.

Genus Cirrhibarbus, Cuv. The general form is that of the preceding genus; the teeth are crowded, and there is a small tentaculum over the eye, and another on the nostril, besides three large ones at the extremity of the muzzle, and eight under the point of the lower jaw. Only one species is known, a native of the Indus. It is of a uniform reddish-yellow colour.

Genus Gunellus. (*Murænoides*, Lacép.) Distinguished from all the other blennies by having the ventrals so

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[1] Griffith's edition of the *Animal Kingdom*, vol. x. p. 300. According to Baron Cuvier, Linnæus and several of his successors have confounded all the European mugils or gray mullets under the single specific name of *M. cephalus*. The French naturalist restricts that denomination to the species characterised above, and which has not yet been detected along our island shores. Our *gray mullet* is the *mugil capito* of Cuvier, an inhabitant not only of the Mediterranean, but also of all the western shores of the temperate parts of Europe. "The partiality," says Mr Yarrell, "exhibited by the gray mullet for fresh water has led to actual experiment of the effect of confining them to it entirely. Mr Arnould put a number of the fry of the gray mullet about the size of a finger into his pond at Guernsey, which is of about three acres area, and has been before referred to under the article *Basse*. After a few years, mullet of four pounds weight were caught, which proved to be fatter, deeper, and heavier for their length, than others obtained from the sea. Of all the various salt-water fishes introduced, the gray mullet appeared to be the most improved. A slight change in the external colour is said to be visible." (*British Fishes*, p. 205.) The same author informs us that the gray mullet is frequently an object of sport to the angler. They rise freely at the flies used for trout, and even at the larger and more gaudy flies used for salmon. They are strong in the water, and require a careful hand in consequence of their impetuous plunging. Our other British species are the thick-lipped gray mullet, *mugil chelo*, Cuv., and a small species described by Mr Yarrell under the name of short gray mullet, *mugil curtus*. We may here remark, that it is unfortunate that the English term *mullet* should be applied both to the subjects of our present note, and to the red and striped mullets, which belong to a very different genus of the family Percidæ, before described. If the latter were termed *surmullets*, or the former *mugils*, the ambiguity of a double application of the same name would be avoided.

small as to be almost imperceptible, and often reduced to a single ray. The head is very small, and the body elongated like the blade of a sword; the back garnished throughout its whole length with a uniform dorsal fin, all the rays of which are simple and without articulations. The teeth are as in the genus *Clinus*, the stomach and intestines of a uniform character.

One species, the common gunnel (*B. gunnellus*), is very abundant on the coasts of Britain, and in other northern seas. It varies from six to ten inches in length, is of a yellowish-brown colour on the body, with the belly white, and the dorsal fin ornamented with a series of dark ocillated spots along the base.

Genus Opistognathus, Cuv. Presents the form of the blennies properly so called, but differs from them in having the maxillaries very large, and prolonged posteriorly into a kind of long flat moustache. The teeth in each jaw are rasp-like, the exterior range being strongest. The ventrals are placed exactly under the pectorals, and consist of three rays. Only one species seems to be known, which was brought from the Indian Ocean by M. Sonnerat, after whom it was named by Baron Cuvier.

Genus Zoarcus, Cuv. The species of this group are destitute of a spiny ray; they have an anal tubercle, the intestines are without cæca, and there are six branchial rays. The ventrals have three rays; the teeth are conic, and placed in a single row along the sides of the jaws, but in several in front; the palate is without teeth. Their dorsal, anal, and caudal fins are united, although the first named experiences a great depression.

The viviparous blenny (*B. viviparus*) is a well-known species, and has been long celebrated for a peculiarity which is chiefly observable among cartilaginous fishes, that, namely, of producing its young alive. These are so matured at the time of their birth, that on their first exclusion they swim about with the utmost agility. No fewer than 200 or 300 young are sometimes produced by an individual, and the abdomen of the mother is so distended before parturition, that it is impossible to touch it without causing them to be extruded. Full-grown individuals seldom exceed twelve inches in length; the body is slender and smooth; the colour yellowish olive, pale beneath, and marked on the upper parts with dusky spots. It is a littoral fish, and of frequent occurrence under stones. When boiled, the back-bone acquires a green colour. America produces a much larger species, which sometimes exceeds the length of three feet. It has been described under the name of *Blennius labrosus*.

Genus Anarrhichas, Linn. Bear so much affinity to the blennies, that the species have been termed by Cuvier Blennies without ventrals. The dorsal fin, entirely composed of simple rays, but without stiffness, begins at the nape, and extends, in common with the anal one, nearly to the caudal fin, which is rounded like the pectorals. The whole body is smooth and covered with mucus. Their palatines, vomer, and mandibles, are armed with large osseous tubercles, which are crowned with small enamelled teeth; but the anterior teeth are longer and conical. Such a conformation of the teeth makes them very powerful instruments, and these fishes, from their large size, are thereby rendered ferocious and dangerous. They have six rays in the gills; the stomach is short and fleshy, with the pylorus near its base; the intestine short, thick, and without cæca; and the swimming bladder is wanting.

The most common species is the *A. lupus*. Plate CCCIV. fig. 2. It is of frequent occurrence in most of the northern seas, and is well known along the coasts of Britain by the names of *sea-wolf* and *sea-cat*. Its ordinary length is from three to four feet, but examples sometimes occur nearly double that size. The colour is obscure livid brown, with several transverse stripes or bands of a darker hue. The dorsal fin, as already mentioned, extends along the whole length of the back, and is composed of seventy-three rays. The fore teeth project considerably, and diverge a little from each other, forming a powerful kind of armature, moved by jaws of such strength that the animal has been known to imprint the marks of its teeth on a bar of iron. The uninviting aspect of this fish has probably not been without influence in producing a prejudice against it as an article of food. Its flesh, however, is far from being unsavoury, and bears considerable resemblance to that of the eel. It is in great request among the Icelanders, who eat it dry and salted; while the other parts of the fish are likewise converted to useful purposes, the skin forming shagreen, and the gall being used as soap.

The gobies (*Gobius*, Linn.) are at once distinguished from their associates by having their thoracic ventrals united, either throughout their whole length, or only towards the base, and forming a single hollow disk, more or less tunnel-shaped.

The spines of their dorsal fins are flexible; the opening of the gills, provided there are only five branchial rays, is generally very small; and, like the blennies, they can live for some time out of the water. Their stomach is without a *cul-de-sac*, and the intestinal canal has no cæca: the males have an appendage, like the blennies, behind the anus; and some species are known to produce their young alive. They are small or middle-sized fishes, and usually frequent rocky places near the margin of the waters which they inhabit. The greater number are provided with a simple air-bladder.

Genus Gobius, Cuv. Includes the *gobies* properly so called. They have their ventrals united throughout their whole length, and even anterior to their base, by a traverse, so as to form a concave disk. Their body is elongated; the head of moderate size, and rounded, the cheeks inflated; and the eyes placed near each other. The back bears two fins, the posterior one rather long. Several species occur in European seas, the characters of which have not been sufficiently examined. They frequent waters having a clay bottom, and pass the winter in excavations which they make for that purpose. In the spring they prepare a kind of nest in places which abound with Fuci, and cover it with the roots of the Zostera: the male remains there waiting the arrival of the females, which come in succession to deposit their eggs. These he fecundates, and afterwards watches and defends courageously.

The black goby (*Gobius niger*, Linn.) is not a scarce species on the coasts of Britain. It is about five inches long, of a dark-brown colour above, and white beneath, variegated with darker spots and stripes. The tail is rounded, and the superior rays of the pectorals are free at the extremity. Several others are found in the Mediterranean, such as *G. jozzo*, *G. capito*, and *G. cruentatus*. A few are inhabitants of fresh waters, such as the small dark-coloured species described by Bonelli under the name of *G. fluviatilis*. Among foreign kinds the most remarkable are the *Cottus macrocephalus* of Pallas, in which the head is unusually large; and the *G. lanceolatus* of Bloch, distinguished by its elongated form, and pointed caudal fin.

The genus named Gobioides by Lacépède differs from the gobies only in having their dorsals united so as to form a single fin, and in the body being more elongated. The Tenioides of the same distinguished Ichthyologist have likewise a continuous dorsal line, and the body is still more lengthened. These fishes present a very peculiar aspect, in consequence of having their upper jaw very short, and the lower one high and convex, rising above it, both of them being armed with long crooked teeth, while the eye is reduced to a mere point, and entirely concealed under the skin. The cavity of the mouth is filled with a fleshy tongue almost of a globular shape, and the lower jaw has a few barbels beneath. The *Tænioides Hermanii* is the only species known: it is a native of the East Indies, and is usually found in the mud of stagnant waters.

GENUS PERIOPHTHALMUS, Schn. Contains such as have the head entirely scaly, the eyes placed quite close to each other, and furnished on their lower margin with an eye-lid capable of covering them; the pectoral fins clothed with scales for more than half their length, which makes them look as if supported by a kind of arm. Their gills being still narrower than those of the other gobies, they can live for a longer period out of the water; and in the Moluccas, their native country, they are often observed to leap out on the mud in order to escape their enemies, or to seize the small shrimps, which form their principal nourishment. In some the ventrals have a concave disk like the gobies properly so called; while in others these fins are separated almost to the base. Plate CCCIV. fig. 3.

GENUS ELEOTRIS, Cuv. In common with the gobies, the fishes referred to this genus have the first dorsal with flexible spines, and an appendage behind the anus; but the ventrals are perfectly distinct, the head obtuse and a little depressed, the eyes remote from each other, and the branchial membrane with six rays. The lateral line is faintly marked, and the viscera resemble those of the *Gobii*. The greater proportion of the species live in fresh water, and often in the mud. That named *E. dormitatrix* is a native of the Antilles; it is of considerable size, with the head depressed, the cheeks dilated, and the fins spotted with black. Others occur in Senegal and the Indies, and a small gilded species, marked with a black spot at the base of the pectoral (the *Gobius auratus* of Riss.), inhabits the coasts of the Mediterranean.

GENUS CALLIONYMUS, Linn. Possesses very strongly marked characters in the gills being open only by a hole on each side of the nape, and in the ventral fins being placed under the throat, remote, and larger than the pectorals. The head is oblong and depressed, the eyes approximating when seen from above, the inter-maxillaries very protractile, and the pre-opercles elongated behind and terminating in a few spines. The teeth are crowded, and are wanting on the palate. They are beautiful fishes, with a smooth skin, and having the anterior dorsal supported by some setaceous rays, occasionally much elevated. The second dorsal is elongated, as well as the anal. The same appendage is observable behind the anus as in the preceding genera. The stomach is not in the form of a *cul-de-sac*, and they are without cæca and air-bladder. Of this handsome genus we may mention as an example the gemmeous dragonet (*C. lyra*), which occurs not unfrequently in the British seas. Plate CCCIV. fig. 4. It derives its specific name from the form of the dorsal fin, which has been thought to bear an obscure resemblance to a lyre. The full-grown fish is about a foot in length. It is of a beautiful orange or yellow colour, spotted and striped with violet; the pupils of the eyes fine deep blue, and the pectoral fins light brown. The sordid dragonet (*C. dracunculus*) differs from the above only in having the dorsal fin short and without a fillet: by many it is conjectured to be the female of *C. lyra*. Several species inhabit the Mediterranean, such as *C. lacerta, cithara, jaculus;* and not a few are found in foreign countries.

GENUS TRICHONOTUS, Schn. Differs from the typical *Callionymi* only in having the body very much elongated, and the continuous dorsal and anal of proportionate extent. The genus COMEPHORA of Lacépède comprehends but one species, from the Lake Baïkal, which is usually found dead after storms, and is of so soft and fat a substance as to afford a considerable quantity of oil. It is distinguished from all the other members of this group by being destitute of ventrals. The genus PLATYPTERON is constituted by a few Indian fishes, which, to the large and remote ventrals of the *Callionymi*, unite a short depressed head, a small mouth, open branchiæ, and large scales: their two dorsals are short and remote.

GENUS CHIRUS, Steller (*Labrax*, Pallas). Placed by Cuvier at the end of this family, presents so many distinctive characters, that it may not improperly be regarded as the type of a new family group. The body is elongated, and garnished with ciliated scales; the head small and unarmed; the mouth but slightly cleft, and furnished with small unequal conical teeth; the spines of the dorsal are almost invariably slender, and that fin extends along the whole back. But their most distinctive feature consists of numerous series of pores, resembling several lateral lines. Their intestines are without cæcal appendages; they have often a tuft on the eye-brow, like certain kinds of blenny; but their ventrals are composed of five soft rays, as is usual in the allied species. All the known kinds, amounting to six or seven in number, are from the sea of Kamschatka, and were first described by Pallas in the 11th volume of the Memoirs of the Academy of Petersburg for 1810.

FAMILY XIII.—PECTORALES PEDICULATI.

This family, in Baron Cuvier's arrangement, comprehends such acanthopterygenous species as have the carpal bone prolonged in order to form a kind of arm, which supports the pectorals. From this peculiarity they have derived their family name. Only two genera are here included, and these are closely allied to each other, although the generality of authors have placed them widely apart.

GENUS LOPHIUS, Linn. Besides the semi-cartilaginous nature of the skeleton, and the want of scales on the skin, has for its general character pectorals supported as if by two arms, each of them sustained by two bones, which have been compared to the radius and cubitus, but which in reality belong to the carpus, and are more elongated in this genus than in any other. The ventrals are placed greatly in advance of the pectorals, and the opercles and rays of the branchiæ are enveloped in the skin, while the gills open only by a single hole, pierced behind the pectorals. The species are voracious; they have a large stomach and a short intestine, and are able to live for a very long period out of the water, on account of the small opening of their gills. The kinds now included in this genus, in the restricted sense attached to it by Cuvier, have the head excessively large in proportion to the rest of the body, and at the same time broad and depressed, and spiny in many places; the opening of the mouth very wide, and armed with pointed teeth; and the lower jaw furnished with numerous barbels. There are two distinct dorsals, of which the anterior possesses some detached rays, moveable over the head, where they rest on a horizontal inter-spinal; the branchial membrane forming a very large sac opening in the axilla, and supported by six very long rays; the operculum small. It is asserted that they lie among the mud, and by putting in motion the rays of their head, attract small fishes, which, mistaking the broad and fleshy extremities of these rays for worms, thus become the prey of the Lophii. It is also said that they can seize and retain their prey by means of their large branchial sacs. Their intestine has two very short cæca towards its origin, and the swimming bladder is awanting. Of these fishes, the most remarkable is the *Lophius piscatorius* of Linnæus. Plate CCCIV. fig. 5. It is a large fish (measuring from four to five feet in length) of the European seas, with a wide mouth, depressed head, numerous teeth, and a bearded tongue. Its aspect is extremely repulsive. The *Mountsbay Angler* of Borlase,[1] and the one from Bristol,[2] are, according to Dr Fleming, only mutilated specimens of the species just alluded to.

The CHIRONECTES (*Antennarius*, Commers.) have free rays on the head, like the preceding, the first being slender, often terminating by a tuft; and the following, increased by a membrane, are sometimes greatly inflated, and at other times united into a single fin. Their body and head are compressed, and the mouth opens vertically; their gill-covers, provided with four rays, open only by a canal, and a small hole behind the pectoral; the dorsal occupies nearly all the back. The whole body is sometimes garnished with cutaneous appendages. The branchiæ are four in number; the swimming bladder is large, and the intestine of moderate size and without cæca. By filling their enormous stomach with air, after the manner of the Tetrodons, they can inflate their abdomen like a balloon. When on land, their fins assist them in creeping, which they do almost after the manner of small quadrupeds, the pectorals, from their position, performing the office of hinder legs. Moving about in this manner, they can live without entering the water for two or three days. They are found in tropical seas; and Linnæus appears to have confounded several species under the name of *Lophius histrio.*

GENUS MALTHE, Cuv. Has the head unusually large and flattened, principally by the projection of the sub-operculum: the eyes placed very far forwards; the muzzle projecting like a little horn, and the mouth situate under it, the latter being of moderate size and protractile; the gill-covers supported by six or seven rays, and open towards the back by a hole above each pectoral; the single dorsal small and soft; the body covered with osseous tubercles, and having barbels along the sides, but there are no free rays over the head. The swimming bladder and cæca are wanting.

GENUS BATRACHUS. Derives its name from a Greek word signifying a frog, to which the species are thought to bear some resemblance, in consequence of the enlargement of the head. The latter is flattened horizontally, and wider than the body; the gape wide, and both the opercle and sub-opercle spiny; the gill-covers six-rayed; the ventrals narrow, attached under the throat, and consisting only of three rays, of which the first is wide and elongated; and the pectorals supported by a short arm, formed by the prolongation of the carpal bone. The first dorsal is short, supported by three spiny rays; the second long and soft, which is also the case with the corresponding anal one. The lips are often garnished with filaments. Such as have been dissected have their stomach in the form of an oblong sac, the intestines short and without cæca. The swimming bladder is deeply furcate anteriorly. They conceal themselves in the sand, lying in ambush for their prey. The wounds made by their spines are supposed to be dangerous. The species, which vary considerably in their form and aspect, occur both in the Pacific and Atlantic Oceans.

FAMILY XIV.—LABRIDÆ.

Easily recognised by its external aspect. The body is oblong and scaly, and the single dorsal fin is supported anteriorly by spines, each of which is generally garnished with a membranous appendage. The jaws are covered by fleshy lips; the two upper pharyngeals are supported against the cranium, and the lower one is large, all the three armed with teeth, sometimes *en pavé*, at other times pointed or in the form of plates, but generally stronger than usual. The intestinal canal is entirely without cæca, or only with two very small ones; and there is a strong swimming bladder.

The genus LABRUS of Linnæus forms an extensive group of fishes, very like each other in their oblong shape, and double fleshy lips (from which circumstance they derive their name), one of which is immediately connected with the jaws, and the other with the sub-orbitals; the gills are serrated, and have five rays; the maxillary teeth conic, the middle and anterior ones being longest; the pharyngeal teeth cylindrical and blunt, disposed *en pavé*, the superior on two large plates, the inferior on a single one corresponding to the two above. The stomach is not in the form of a cul-de-sac, but is continuous with an intestine without cæca, which, after two convolutions, terminates in a large rectum. The swimming bladder is robust and simple. The species are numerous, and the colours of many of them liable to so much variation that it is difficult to distinguish them with precision.

In recent times the Linnæan genus has been subdivided as follows:

GENUS LABRUS, properly so called. Opercle and preopercle destitute both of spines and dentations; cheeks and opercle covered with scales; lateral line straight, or nearly so.

Four different kinds have been described as inhabiting the British seas, but some of these seem to be mere varieties, such, for example, as the *L. balanus* and *L. comber* of Pennant, which are probably referrible to the *Labrus maculatus* of Bloch. *L. lineatus* is likewise a British species. The ground colour is reddish, with one or more irregular clouded bands of a deeper colour along the flanks. The dorsal has from sixteen to seventeen spines, and is marked with a dark-coloured spot anteriorly.

GENUS CHEILINUS, Lacép. Differs from the *Labri* properly so called, by the lateral line being interrupted opposite the dorsal fin, and commencing again a little lower. The scales at the extremity of the tail are large, and partially envelope the base of the caudal. They are fishes of considerable beauty, and are found in the Indian seas.

The next genus of interest is that named JULIS, in which the head is entirely smooth and without scales, and the lateral line is much bent opposite the end of the dorsal. Several species occur in the Atlantic and Mediterranean, and most of them are of very beautiful colours. The most common European one (*Labrus Julis*, Linn.) is frequent in the Mediterranean, and has likewise been found on the coast of Cornwall. It is about seven inches in length, and of a beautiful violet, relieved by a bright zigzag orange band on each side.

GENUS CRENILABRUS has been separated by Cuvier from the *Lutjani* of Bloch, and associated with the *Labri*, to which all their characters, both external and internal, correspond, except the dentation of the edge of the preopercle. (See Plate CCCIV. fig. 6.) Several species are found in the northern seas, such as *Lutjanus rupestris*, Bloch, 250, of a yellow colour, with clouded vertical bands. The British species (*C. tinca*) known under the name of *old wife*, or *wrasse*, belongs to this genus, as does likewise the *gibbous wrasse* of Pennant's *British Zoology*. The Mediterranean furnishes a great number adorned with the most beautiful colours, such as the *Labr. lapina*, Forsk, which is silvery, with three broad longitudinal

[1] *Cornwall*, 266, t. 27, f. 6.

[2] *Phil. Trans.* liii. p. 170, t. 13.

bands formed by dots of vermillion; the pectorals yellow, and the ventrals blue. Many likewise occur in tropical countries, of which we may mention *Lut. verres* (Bl. 255), *Lut. notatus*, *L. virescens*, and *L. chrysops*.

To the characters of the *Crenilabri*, the genus Coricus of Cuvier joins that of a mouth nearly as protractile as in the *Epibuli*. The latter group are very remarkable for this property, being capable of extending it to a great length, and suddenly forming it into a kind of tube by a peculiar movement of the maxillaries. They practise this artifice to seize small fishes as they swim within reach of this singular instrument. Several allied genera avail themselves of the greater or less protractility of their jaws to procure their food in a similar manner.

The whole body, and the head of the *Epibuli*, are covered with large scales, the hinder row of which encroaches even on the anal and caudal fins, as likewise takes place among the *Cheilini*. The lateral line is interrupted in a similar manner, and, in common with these last-named fishes, and the *Labri*, they have two long conical teeth in front of each jaw, and behind them small blunt ones. Those of the pharynx have not been observed. The *Sparus insidiator* of Pallas is the only species hitherto discovered. It is of a reddish colour, and found in the Indian Ocean.

Genus Clepticus. Furnished with a small cylindrical muzzle, which rises suddenly like that of the *Epibuli*, but is not so long as the head, and scarcely permits the view of a few small teeth; the body is oblong, the head obtuse, the lateral line continuous, and the scales envelope the dorsal and anal fins, almost as far as the summit of the spines. The only ascertained species (*C. genizara*) is of a reddish purple colour, and inhabits the Antilles.

Genus Elops, Commers. *Gomphosis*, Lacép. Has the head entirely smooth, as in *Julis*, but the muzzle is in the form of a long and slender tube, formed by the prolongation of their inter-maxillaries and mandibularies, which the integuments bind together as far as the small opening of the mouth. Of these fishes, the *Gomphosis cæruleus*, and *G. variegatus*, Lacép., may serve as examples. They are taken in the Indian seas, and many of them are said to form a delicious article of food. The preceding genera, from *Labrus properly so called* inclusive, may be all regarded as Linnæan *Labri*. We now come to

Genus Xirichthys, Cuv. Which comprehends fishes resembling the *Labri* in form, but they are very much compressed, and the forehead descends suddenly towards the mouth by a deep and nearly vertical line, formed by the ethmoid and the ascending branches of the inter-maxillaries. The body is covered with large scales; the lateral line interrupted; the jaws armed with a row of conical teeth, of which the medial ones are longest, and the pharynx paved with hemispherical teeth; the intestinal canal is continuous, with two convolutions, and no cæca, nor is the stomach in the form of a cul-de-sac. They possess a pretty large air-bladder.

Naturalists, anterior to the time of Cuvier, ranged the species with the *Coryphænæ*, from which they greatly differ in their structure, internal as well as external. They approximate to the *Labri*, to which, however, they are dissimilar in the profile of the head.

Genus Chromis, Cuv. Has the lips and protractile inter-maxillaries, the pharyngeal bones, and dorsal filaments, of the *Labri*; but the teeth are *en carde* upon the jaws and pharynx, with an anterior range of a conical shape. The vertical fins are filamentous, and even those of the abdomen are often prolonged into long filets, and the lateral line is interrupted. The stomach is a cul-de-sac, but there are no cæca. One small species, of a chestnut-brown colour (*Sparus chromis*), is found in immense numbers in the Mediterranean. The Nile produces another, which attains the length of two feet, and is regarded as the best fish occurring in Egypt. It is the *Labrus Niloticus* of Hasselq. and Sonnini. The genus Cychla differs from the preceding by having all the teeth crowded, and placed in a broad band, and by the body being more elongated. Plesiops, Cuv., has the head compressed, the eyes near each other, and the ventrals very long. Malacanthus possesses the general characters of the *Labri*, and the maxillary teeth are also similar to theirs, but those of the pharyngeals are *en carde;* the body is lengthened, the lateral line continuous, the opercle terminated by a small spine, and the long dorsal has only a small number of slender, flexible, anterior spines. One species is found in the Antilles, of a yellowish colour, irregularly rayed across with violet; it is the *Coryphena plumieri*, Lacép. iv. viii. 1.

Genus Scarus, Linn. Comprehends fishes very remarkable on account of the form of the jaws (that is, their inter-maxillary and pre-mandibularybones), which are convex, rounded, and garnished with teeth like scales upon their edges and anterior surface; these teeth succeed each other from behind forwards, so that those of the base are the newest, and in time come to form a range upon the cutting edge. Naturalists have erroneously thought that the jaw-bones themselves were naked or exposed. These jaws are, besides, covered while the fish is alive by fleshy lips, but there is no double lip adherent to the sub-orbitaries. The species have the oblong form of Labrus, with large scales, and the lateral line interrupted; they bear on their pharynx two plates above and one below, garnished with teeth like the pharyngeal plates of the Labri, but these teeth are in the form of transverse laminæ, and not *en pavé*.

Cuvier is of opinion that the *Scarus creticus* of Aldrovandus is the species so celebrated under the name of *Scarus* by the ancients, and in search of which (in the time of Claudius) Elipertius Optatus, the commander of the Roman fleet, went to Greece, with a view to effect its introduction to the Italian seas. It is still used in our days as an article of food in Greece. The species are numerous in the seas of warm climates, and are vulgarly known, on account of the peculiar form of the jaws, and the splendour of their colours, under the name of parrot fishes.

FAMILY XV.—FISTULARIDÆ.

Characterised by a long tube formed in front of the cranium, by the prolongation of the ethmoid, the vomer, the pre-opercles, inter-opercles, &c. at the end of which the mouth is placed, composed, as usual, of inter-maxillaries, maxillaries, palatines, and mandibularies. The intestine is without any considerable inequalities, or many convolutions, and their ribs are either short or wanting. Some of them (the *Fistulariæ*) have the body cylindrical, others (the *Centrisci*) have it oval and compressed.

Genus Fistularia, Linn. Acquires its name from the long tube common to all the family. The jaws are at the extremity, opening but little, and nearly in a horizontal direction. The head, thus elongated, composes a third or fourth part of the whole body, which is itself long and slender. There are six or seven rays in the gills; the osseous appendages likewise extend behind the head to the anterior part of the body, which they tend more or less to strengthen. The dorsal corresponds to the position of the anal, and the stomach, in the form of a fleshy tube, is continuous with a narrow canal, without folds, at the commencement of which there are two cæca. In Fistularia properly so called, there is only one dorsal, which, as well as the anal, is composed chiefly of simple rays; the inter-maxillaries and lower jaw are armed with small teeth;

and between the lobes of the caudal there issues a filament sometimes as long as the whole body; the tube of the muzzle is very long and depressed, the swimming bladder excessively large, and the scales invisible. In the subdivision called AULOSTOMA by Lacépède, a name derived from αυλος, *a flute*, and στομα, *the mouth*, the dorsal is preceded by numerous free spines, and the jaws are without teeth. The body, which is very scaly, is broad, and compressed between the dorsal and anal, the latter followed by a short, small tail, terminated by the usual fin. The tube of the muzzle is rather short, large, and compressed; the swimming bladder very large. We are acquainted with only one species (*Fistularia chinensis*, Bl.), which is found in the Indian seas.

The CENTRISCI of Linn. possess the tubular trunk of this family; the body, however, is not elongated, but oval or oblong, compressed laterally, and sharp on the under side; the gills have only two or three slender rays; the first dorsal is spiny, and the small ventrals are placed behind the pectorals. The mouth is extremely small, and opens obliquely; the intestines are without cæca, folded three or four times; and the swimming bladder is of considerable size. In CENTRISCUS *properly so called*, the anterior dorsal, which is placed very far forwards, has its first spine long and strong, supported by an apparatus connected with the shoulder and head. The species are covered with small scales, and have several broad and denticulated plates on the apparatus just mentioned. The *C. scolopax*, or trumpet-fish, is a very common species in the Mediterranean, about five inches long, and of a silvery lustre. (See Plate CCCIV. fig. 7.) It occurs occasionally on the south-western coasts of England. In the sub-genus AMPHISILE, the back is defended with large scaly pieces, of which the anterior spine and the first dorsal have the appearance of being a continuation. All the species hitherto known to us are from the Indian seas: we may mention as examples, *Centriscus scutatus*, Linn., and *Centriscus velitaris*, Pallas.

We here terminate our abstract of the ACANTHOPTERYGII, or first great order or division of the ordinary fishes.

The second division of common fishes, or that named MALACOPTERYGII, contains within itself three orders, which admit of being characterised by the position of the ventrals, or, in certain cases, by their absence.

ORDER II.[1]—MALACOPTERYGII ABDOMINALES.

These are distinguished by having their ventrals suspended to the under part of the abdomen, and behind the pectorals, without any attachment to the shoulder bone. This is the most numerous of the three orders, and includes a large proportion of the fresh-water fishes. It is divisible into five families.

FAMILY I.—CYPRINIDÆ.

May be known by having the mouth but slightly cleft, the jaws weak and generally without teeth, and their edge formed by the inter-maxillaries; by pharyngeals strongly toothed, thus compensating for the imperfect armature of the jaws; and by the branchial rays being few in number. Their body is scaly, and there is no adipose dorsal, such as is observed in Siluri and salmon. Their stomach has no cul-de-sac, and the pylorus is without cæcal appendages. They are the least carnivorous of fishes.

Malacopterygii Abdominales. Cyprinidæ.

The typical genus CYPRINUS is a very natural one, and comprehends a great number of species, which are readily distinguished by the small mouth, toothless jaws, and the three flat branchial rays. Their tongue is smooth, and the palate provided with a soft and singularly irritable substance, vulgarly known by the name of *Carp's tongue.* The pharynx presents a powerful instrument for mastication, consisting of large teeth attached to the inferior pharyngeal bones, and capable of pressing the food between them, and a stony disk enclosed in a wide cavity under an apophysis of the basilary bone. These fishes have only one dorsal, and the body is covered with scales, most frequently of large size. They inhabit fresh waters, and are perhaps the least carnivorous of their class, subsisting chiefly on grains, grass, and even on mud. Their stomach is continuous, with a short intestine without cæca, and the bladder is divided into two by a constriction.

The genus CYPRINUS,[2] Cuv. including the *Carps* properly so called, has a long dorsal, which, as well as the anal, has a spine for the second ray. Of these, some have barbels at the angles of the upper jaw, and others are destitute of these appendages. Of the former we may cite as an example the common carp; and the gold fish of China affords an instance of the latter.

Cyprinus carpio, the common carp. This well-known fish is of an olive-green, yellowish beneath, having the anal and dorsal spines strong and denticulated, and the barbels short; the pharyngeal teeth are flat and striated on the crown. It is a native of the central countries of Europe; but, owing to its value as an article of food, it was early distributed by human agency over the whole of that Continent. The ease with which it can be transported from one place to another, and its speedy growth and propagation in ponds and artificial reservoirs, afforded great facilities for its rapid dispersion. The year 1614 is assigned as the date of its first introduction into England; but it was naturalized in Germany and Sweden nearly half a century before that period. It delights in tranquil waters, preferring such as have a muddy bottom, and the surface partially shaded with plants. Its food consists of the larvæ of aquatic insects, minute Testacea, worms, and the tender blades and shoots of plants. The leaves of lettuce, and other succulent plants of a similar kind, are said to be particularly agreeable to them, and to fatten them sooner than any other food. Although the carp eats with great voracity when its supply of aliment is abundant,—to such a degree, indeed, as sometimes to produce indigestion, which occasionally proves fatal,—it can subsist for an astonishing length of time without nourishment. In the winter, when they assemble in great numbers, and bury themselves among the mud and the roots of plants, they often remain for many months without eating. They can also be preserved alive for a considerable length of time out of the water, especially if care be taken to moisten them occasionally as they become dry. Advantage is often taken of this circumstance to transport them alive, by packing them among damp herbage, or wet linen; and the operation is said to be unattended with any risk to the animal, especially if the precaution be taken to put a piece of bread in its mouth *steeped in brandy!* In a similar way, the Dutch preserve them by suspending them from the roof of a damp apartment in a bag-net filled with moss, which is continually kept moist,

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[1] Of the general CLASS of Fishes.

[2] The name is of Grecian origin, and was applied to the species because they were dedicated to Venus, in consequence of their extraordinary fecundity.

and they are fed with vegetables and bread steeped in milk,—a mode of treatment by which they are not only kept alive, but actually thrive and fatten.

The fecundity of these fishes is very great, and their numbers consequently would soon become excessive, but for the many enemies by which their spawn is destroyed. No fewer than 700,000 eggs have been found in the ovaria of a single carp, and that too by no means an individual of the largest size. Their growth is very rapid, more so perhaps than that of any other fresh-water fish, and the size which they sometimes attain is very considerable. In certain lakes in Germany and Prussia, individuals are occasionally taken weighing thirty or forty pounds; and Pallas relates that they occur in the Volga five feet in length, and even of greater weight than the examples just alluded to. The largest of which we have any account is that mentioned by Bloch, taken near Frankfort-on-the-Oder, which weighed seventy pounds, and measured nearly nine feet in length.

Cyprinus auratus (gold fish). This beautiful species, the most brilliantly adorned of all our fresh-water fishes, and scarcely surpassed even by the more richly ornamented inhabitants of the ocean, is well known to be a native of China, although it is now domesticated, so to speak, in almost every country, both of the old and new world. Like the carp, it has the dorsal and anal spines denticulated. When young it is of a blackish colour, and it gradually acquires the fine golden red by which it is characterised; but some examples are of a silvery hue, and others are variegated with three different shades of colour. Like most other animals that have been long estranged from their natural habits, and subjected to artificial influences, this species presents a great many varieties, extending even to some important parts of structure. Individuals occur without a dorsal, others with a very large one, others with the caudal greatly enlarged, and divided into three or four lobes; and in some instances the eyes are enormously dilated.[1] The golden carp is said to have been originally confined to a lake near the mountain *Tsienking*, in the province of *The-kiang*, in China, about the 30th degree of N. lat. It was first brought to England in 1691, but was very scarce till 1728, when a considerable number were imported, and they soon became generally known. They do not flourish in rivers and open ponds, not, however, because such places are uncongenial to them, but because they are exposed to many enemies, against which they have no means of defence. When kept in confinement they ought to be nourished with fine crumbs of bread, small worms, flies, and yolks of eggs dried and powdered, and the water ought to be frequently changed. The ordinary length of this species is from four to six inches; but they have been sometimes known to reach a foot. Although natives of a warm climate, they can sustain a great degree of cold uninjured. An individual, which was accidentally exposed during the night, was completely frozen up in the centre of its glass jar; but as the ice thawed it recovered its vigour, and seemed to suffer no further inconvenience.

To this group belongs the smallest of the European Cyprini, viz. *C. amarus*, which is about an inch long, greenish above, and of a fine red beneath. During the time of spawning, which takes place in April, it has a steel-blue line on each side of the tail; the second dorsal ray forms a rather stiff spine.

Genus Barbus of Cuvier, contains such species as have the dorsal and anal short, with a strong spine for the second or third ray of the dorsal, and four barbels, two of which are at the extremity, and two at the angles of the upper jaw. As an example, we may refer to the *Cyprinus barbus*, or barbel, which may be known by its oblong head. It is very common in clear and running waters, where it sometimes attains to a length exceeding ten feet. Several allied species are found in Italy, having the spine weaker, but which, nevertheless, differ from the following genus by possessing four barbels. Such are *Barbus caninus*, Bonnelli; *B. plebeius*, Val.; *B. eques*, Id. Various species of Barbi occur in the Caspian Sea, in the Nile, and in India; and not a few have been ascertained to inhabit America.

Genus Gobio, Cuv. Has the dorsal and anal short, both of them without spines, and the mouth furnished with barbels. Of this genus the gudgeon (*Cyprinus gobio*) may be cited as an example. It is a small fish, seldom exceeding seven or eight inches, and is found in most parts of Europe in small lakes and gently flowing rivers. It is of a pale olive-brown colour, slightly spotted with black, especially on the fins, the sides and abdomen being silvery white. It spawns in the spring, and as it deposits its ova at distant intervals, the operation generally continues for a considerable time. It is a very prolific fish; and as its flesh is of a very delicate flavour, it is much sought after for the table.

Genus Tinca, Cuv. Unites to the characters of the gudgeons that of having very minute scales; their barbels also are very small. This genus includes the common tench (*Cyprinus tinca*, L.), which is of a deep yellowish brown, sometimes, however, assuming a fine golden colour. Its usual length is from twelve to fourteen inches; but instances are on record of its having reached three feet. It inhabits stagnant waters with a muddy bottom; and in the winter conceals itself among the mud, and seems to undergo a kind of torpidity. In May and June it deposits its ova among aquatic plants; these are very minute, of a green colour, and so numerous that 297,000 have been reckoned in one female. The tench is very extensively distributed, appearing to occur throughout the whole globe. Its flesh is not much esteemed, as it is soft, insipid, and difficult of digestion.

Genus Abramis, Cuv. Distinguished by wanting spines and barbels; the dorsal is short, placed behind the ventrals, and the anal long. Two species are known, the common bream (*Cyp. brama*), and the little bream (*Cyp. blicca*, *C. latus*, Gm. Bl. 10). The former is the largest fish in this subdivision; there are twenty-nine rays in the anal, and all the fins are obscure. It is common in slow flowing rivers and lakes in most European countries. It sometimes acquires two feet and a half in length, but its ordinary dimensions may be stated to be about a foot. Worms, confervæ, and aquatic plants are its usual food; but, like many allied species, it often swallows mud, which renders its flesh unsavoury. "There exists in the river Trent, in the neighbourhood of Newark, two species or varieties of bream. The common bream, *Cyprinus brama*, is known there by the name of Carp Bream, from its yellow colour, and has been taken of nearly eight pounds weight. The other species or variety, which I believe to be a non-descript, never exceeds a pound in weight. It is of a silvery hue, and goes by the name of White Bream."[2]

Omitting the genera Labeo and Catastomus, of which the species are all foreign, and imperfectly known, we now come to the generic group named Leuciscus (Klein), comprehending several kinds indigenous to Europe. They have the dorsal and anal short, and are destitute of spines and barbels, and there is nothing particu-

[1] The varieties of this species have afforded materials for a kind of monograph by Sauvigny, and a painter of the name of Martinet.
[2] *Linn. Trans.* xiv. p. 587.

lar in the structure of the lips. The species of this subdivision are considerable in amount, but they are held in little estimation as articles of food. They are distinguished by the position of the dorsal, a character, however, which is not always sufficiently defined. In some it corresponds to the position of the ventrals; such is the case with *Leuc. dobula* (*Cyprinus dobula*, Linn.), in which the head is broad, the muzzle rounded, and the pectorals red. *Leuc. rutilus* (the roach), has the body compressed and silvery, and all the fins red. In others, the dorsal corresponds above to the interval which is between the ventrals and the anal. This is exemplified in *Leuc. alburnus* (the bleak), in which the body is narrow, and of a brilliant silvery hue; the fins pale; the forehead straight, and the inferior jaws somewhat elongated. It is common throughout Europe; and is one of the fishes whose nacre (or silvery-looking substance) is employed in fabricating artificial pearls. *Leuc. phoxinus* (common minnow) likewise pertains to this group. The appearance of this beautiful little fish is familiar to all. It is the smallest species of the genus found in Europe, the greatest length which it attains seldom exceeding three inches. It first makes its appearance in March, and disappears in October, passing the winter beneath the mud. It is well known to be a gregarious species, and small shoals are to be found in almost every shallow stream, especially in clear weather, as they seem to delight in warmth and sunshine. They usually spawn in the month of June, but their ova are often found at a much later period. The flesh of the minnow is delicate and well flavoured, but its size is too small to admit of its being of much value as an article of food. It is principally used as a bait for the capture of larger kinds.

Certain species of the present genus (the Chelæ of Buchanan) have the dorsal corresponding to the commencement of the anal, and in several of these the body is compressed nearly in the same manner as in some of the *Clupeæ*. Such is *Leuc. cultratus*, which is further remarkable for its lower jaw, which ascends in front of the upper, and for its large pectorals shaped like a scythe.[1] The generic group Gonorhynchus, *Gronov.* is dissimilar from all the other Cyprini, by having the body and the head elongated, and covered, as well as the opercula, and even the membrane of the branchiæ, with small scales; the muzzle projecting in front of the mouth, which is small, and without teeth or barbels; three branchial rays, and a small dorsal above the ventrals. Only one species is known (*Cyprinus gonorhynchus*, Gm.), which is found at the Cape of Good Hope.

Genus Cobitis (loach). Has the head small, the body elongated, clothed with scales, and covered with a mucous matter; the ventrals placed behind, and above them a small single dorsal; the mouth at the end of the muzzle, but little cleft and without teeth, but surrounded with lips fitted for sucking, and by barbels; gill-covers little opened, and having only three rays. Their inferior pharyngeal bones are rather strongly dentated, their intestines are without any cæca, and their swimming bladder, which is very small, is enclosed in an osseous bilobate case, attached to the third and fourth vertebræ. Three species are found in the fresh waters of Europe, viz. *C. barbatula*, *C. fossilis*, and *C. tænia*. The first of these, the bearded loach, is a well-known fish in this country, as it occurs plentifully in almost every small stream. It is about four or five inches long. The second species, which does not occur in Britain, measures sometimes a foot in length. It dwells in the mud of ponds, and is so tenacious of life as to live a long time after being stiffly frozen, or even dried. In stormy weather it rises to the surface and agitates the water. It swallows quantities of air, which it converts, according to M. Ehrman's observations, into carbonic acid. Its flesh is soft, and savours of mud. The third species was introduced into the British Fauna by Berkenhout. Turton says it occurs in the "clear streams of Wiltshire."

The fishes which Bloch distinguished by the name Anableps (a term first used by Artedi, and signifying to raise the eyes, or to look up, being derived from ἀναβλέπω) were long united with the loaches, although they afford characters of a very distinctive kind. Their eyes, which are very salient, and placed under an arch formed on each side by the frontal bone, have the cornea and iris divided into two portions by transverse bands, in such a manner that they have two pupils, and appear double, although in reality there is only a single crystalline and vitreous humour, and one retina,—a peculiarity of which no other instance is to be found among vertebrate animals. The organs of generation, moreover, and the bladder of the male, have their excretory canal in the anterior border of the anal fin, which is thick, long, and clothed with scales; its extremity is perforated, and no doubt subserves the generative functions. The female is viviparous, and the young are not produced till they have attained a considerable size.

The body of these fishes is cylindrical, and covered with scales; there are five branchial rays, the head is flat, the muzzle truncated, the mouth cleft transversely at the end, and armed in both jaws with numerous small teeth. The inter-maxillaries are without a pedicle, and suspended under the nasal bones, which form the anterior edge of the muzzle. The pectorals are in a great measure scaly, and a small dorsal is placed over the tail, and further back than the anal. Their pharyngeal bones are large, and provided with numerous small globular teeth; their air-bladder is very large, and also their intestine; but the latter is without cæca. Only one species is known, which is an inhabitant of the rivers of Guiana. It is the *Anableps tetropthalmus*, Bl. 361. See Plate CCCIV. fig. 8.

Genus Pœcilia, Schn. Has the two jaws flattened horizontally, protractile, slightly cleft, furnished with a series of small and very fine teeth, the upper side of the head flattened, the opercula large, five branchial rays, the body not much elongated, the ventrals not far back, and the dorsal placed just above the anal. They are all small viviparous fishes, and inhabit the fresh waters of America. The only remaining genera included in the present family are Lebias, Cuv., Fundulus, Lacép., Molinesia, Lesueur, and Cyprinodon, Lacép., which comprehend but a limited number of species, most of them of small size, and presenting no peculiarities of particular interest.

FAMILY II.—ESOCIDÆ.

Corresponds to the undivided genus Esox, as established by Linnæus. It is characterised by the want of the adipose dorsal; by having the edge of the upper jaw formed by the inter-maxillary, or at least, when not wholly formed by that bone, the maxillary is without teeth, and concealed in the thickness of the lips. They are a very voracious tribe of fishes; their intestine is short and without cæca, and all are provided with a swimming bladder. With the exception of the *Microstoma*, all the kinds with which we are acquainted have the dorsal opposite the anal.

In the Cuvierian system this family is divided into many genera, of the principal of which we shall now proceed to give some account. Such fishes as belong to

Genus Esox, in its present restricted acceptation, have

[1] The genus Leuciscus contains also the dace, chub, and other well-known British species.

small inter-maxillaries provided with minute pointed teeth in the middle of the upper jaw, of which they form the two thirds; but the maxillaries occupying the sides are without teeth. The vomer, the palatines, the tongue, the pharyngeals, and the arches of the branchiæ, are covered with teeth resembling those of a card; and, in addition to these, a series of long pointed teeth occupy the sides of the lower jaw. The snout is oblong and obtuse, broad and depressed; and there is only one dorsal opposite the anal. The stomach, which is large and plicate, is continuous with a slender doubly-folded intestine without cæca. The swimming bladder is very large. There is only one European species, viz. *Esox lucius*, Linn. (the common pike), Plate CCCIV. fig. 9. During the earliest stage of its life it is of a greenish hue, but in the second year it becomes gray with pale spots, the latter ultimately acquiring a yellowish colour. Its markings, however, are very variable, and instances have occurred of its being perfectly white. It is one of the largest of fresh-water fishes, and indeed, if the accounts which some writers give are not exaggerated, it occasionally attains a size not greatly inferior to the gigantic inhabitants of the ocean. Individuals are recorded as measuring from five to nine feet in length. They frequently weigh above thirty pounds in the lakes of the north of England; and Dr Grierson mentions one taken in Loch Ken, in Galloway, which weighed sixty-one pounds. Bloch indeed examined a portion of the skeleton of another which could not be less than eight feet in length. The most remarkable pike, however, of which we have any authentic account, is that caught at Kaiserslautern, near Manheim, in 1497, which was nearly nineteen feet in length, and weighed 350 pounds. The skeleton of this extraordinary specimen was for a long time preserved, and bore a brass ring with an inscription to the effect that the fish was put into a pond by the hands of the Emperor Frederick II., the 5th of October 1262. From this it is inferred that it was upwards of 235 years old. Pikes are proverbially voracious. There seems indeed to be no bounds to their gluttony, for they devour indiscriminately whatever edible substances they fall in with, and almost every animal they are able to subdue. "It is," says M. de Lacépède, "the shark of the fresh waters; it reigns there a devastating tyrant, like the shark in the midst of the ocean; insatiable in its appetites, it ravages with fearful rapidity the streams, the lakes, and the fish-ponds where it inhabits. Blindly ferocious, it does not spare its species, and even devours its own young; gluttonous without choice, it tears and swallows with a sort of fury, the remains even of putrified carcasses. This blood-thirsty animal is also one of those to which nature has accorded the longest duration of years; for ages it terrifies, agitates, pursues, destroys, and consumes the feeble inhabitants of the waters which it infests; and as if, in spite of its insatiable cruelty, it was meant that it should receive every advantage, it has not only been gifted with strength, with size, with numerous weapons, but it has also been adorned with elegance of form, symmetry of proportions, and variety and richness of colour."[1] A singular instance of its voracity is related by Johnston, who asserts that he saw one killed which contained in its belly another pike of large size, and the latter on being opened was found to have swallowed a water-rat!

The pike inhabits almost all the fresh waters of Europe, but seems to flourish most in the northern and middle countries. It likewise occurs in abundance in Asia and North America. Its flesh is well flavoured and easy of digestion, and is consequently much sought after as an article of food, especially for convalescents, and others of weakly habit. It is most tender and nutritive in young individuals, but full-grown pikes are occasionally found, in which the flesh on the back and near the vertebral column acquires a greenish colour, which is held in high repute, and often purchased at a great price.

Genus Galaxias, Cuv. Has the body without apparent scales, the mouth slightly cleft, pointed teeth of moderate size on the palatines and both jaws, the upper jaw having almost its entire edge formed by the inter-maxillary. There are also some strong hooked teeth on the tongue. The *Esox truttaceus*, Cuv., *Esox alepoditus*, Forst. exhibits the structure above described.

Genus Alepocephalus, Risso. The species of this genus bear a very close resemblance in their general form to those of the preceding group, but their head only is destitute of scales, the body being covered with scales of large size; their mouth is small, and the teeth small and crowded. The eye is very large, and the gills have eight rays. Only one species is known, and it inhabits the deepest parts of the Mediterranean. It is the *A. rostratus*, Risso, 2d ed. f. 27.

Genus Microstoma, Cuv. Have the snout very short, the lower jaw more advanced, and furnished, as well as the small inter-maxillaries, with very fine teeth; three broad and flat branchial rays; the eye large, the body elongated, and having the lateral line garnished with a series of strong scales. There is a single dorsal a little behind the position of the ventrals, and the intestines are similar to those of the pikes. The only species known (*Serpa microstoma*, Risso, p. 356) inhabits the Mediterranean.

Genus Stomias, Cuv. Muzzle extremely short, the mouth cleft almost to the gills, the opercula reduced to small membranous leaflets, and the maxillaries fixed to the cheek; inter-maxillaries, palatines, and mandibles armed with small bent teeth, and the tongue with similar ones. Their body is elongated, their ventrals altogether behind, and their dorsal opposite their anal, on the hinder extremity of the body. We are acquainted with two species of these singular fishes, *Esox boa*, Risso, and *Stomias barbatus*, both from the Mediterranean.

The genera Chauliodus (of which the sole species, found near Gibraltar, is shown on Plate CCCIV. fig. 10), Salanx, and Belone, comprehend a few species found chiefly in the Mediterranean. In the last-mentioned genus, the inter-maxillaries form the whole edge of the upper jaw, which is prolonged, as well as the inferior, into a long snout, and both provided with small teeth; there are no other teeth in the mouth, and those of the pharynx are *en pavé*. Their body is long, and covered with indistinct scales, except a longitudinal carinated range on each side, near the inferior edge. The bones are very remarkable for their fine green colour. The intestines differ in their structure from those of the pikes. One species inhabits the European coasts, which is about two feet long, green above, and white beneath. It affords a good dish, in spite of the prejudice caused by the colour of its bones. It is the *Esox belone*, sea-pike, or *gar-fish*. Species nearly allied are to be found in all seas. Of these, one is said to reach eight feet in length, and its bite is reported to be dangerous.

Genus Scomber-esox, Lacép. Has a snout of the same structure as in *Belone*, nearly the same appearance and arrangement of the scales, but the last rays of the dorsal and anal are detached in spurious fins, as in the mackerels. One of them occurs in the Mediterranean, viz.

[1] Quoted in Griffith's edition of the *Règne Animal*. We cannot, however, agree with M. Lacépède in his admiration of the general appearance of the pike, for we think its long lank jaws and sunken eye give it rather a diabolical aspect.

Esox saurus, Bl. Sch. pl. lxxviii. 2, and is also found along the British shores, where it is known under the name of *Egyptian herring*. It sometimes leaps so actively out of the water as to pass over a space of thirty or forty feet. Of the nearly allied genus Hemi-ramphus, Cuv. several species are to be found in the warm latitudes of both hemispheres. Although their flesh is oily, it is of an agreeable taste.

We now come to a tribe of fishes which have attracted much attention, owing to the power they possess of leaping to a great height into the air, and even sustaining themselves in that element for a perceptible time. This faculty, which has caused them to be named *flying fishes*, they owe to the excessive development of their pectorals, a peculiarity which readily distinguishes them from all other abdominal fishes. Their head and body are clothed with scales, and a longitudinal series of carinated scales forms a salient line at the bottom of each flank, as in some of the genera last described. The head is flattened above and on the sides; the dorsal is placed above the anal, the eyes are large, the inter-maxillaries without pedicles, and themselves forming the edge of the upper jaw. The two jaws are furnished with small pointed teeth, and the pharyngeal bones with teeth *en pavé*. Such as present these characters are to be referred to the

Genus Exocetus, Linn., a name which signifies *lying out*, and which was given by the ancient Greeks to a fish that was reported to be in the habit of coming to repose on shore. They are further characterised by having ten branchial rays, a very large swimming bladder, and straight intestines without cæca; the upper lobe of the caudal fin is the shortest.

The *Exocetus volitans*, Bloch, 398 (see Plate CCCIV. fig. 11), is a well-known flying fish of the ocean (but not to be confounded, as it has sometimes been, with the *Trigla volitans*, or flying gurnard, already alluded to under the genus Dactylopterus). It is common in many of the warmer parts of the northern hemisphere, especially between Teneriffe and the line. It is also said to occur occasionally in the Mediterranean, and may be recognised by its large eyes, and the smallness of the ventral fins, which are placed in advance of the centre of the body. Its mouth is slightly tubular, its scales deciduous, and its size from six to twelve inches. A species more common in the Mediterranean is the *E. exiliens*, Bloch, 397, of which the ventrals are long, and placed behind the centre of the body. It attains to the length of fifteen inches. The young have black bands upon the fins.

Some difference of opinion seems still to exist in regard to the mode of flight in these fishes. Mr Bennet supposes, that because they do not use their pectoral fins in the air precisely as birds use their wings, that their progression ought rather to be termed leaping than flying. "In fish," he observes, "the organ of motion for propelling them through the water is the tail, and the fins direct their course; in birds, on the contrary, the wings are the organs of motion, and the tail the rudder. The only use of the extended pectoral fins in the fish is for the purpose of supporting the animal in the air, like a parachute, after it has leaped from the water by *some power* which is possessed even by the whale. From the structure of the fin, I cannot consider it at all calculated for repeated percussions out of the water; while in that fluid, it continues its natural action uninjured; but it soon dries when brought into contact with the air, and the delicacy of the membrane between the rays would very readily become injured were the organ similarly exerted in that medium. The greatest length of time that I have seen these *volatile* fish on the *fin*, has been thirty seconds by the watch.... Their usual height of flight is from two to three feet; but I have known them come on board at a height of fourteen feet; and they have been well ascertained to come into the channels of a line-of-battle ship, *i. e.* as high as twenty feet and upwards. But it must not be supposed that they have the power of elevating themselves in the air, after having left their native element: on watching them, I have often seen them fall much below the elevation at which they first rose from the water, but never in any one instance could I observe them raise themselves above that height. I therefore regard the elevation they take to depend on the power of the first spring or leap they make on leaving their native element."[1] Colonel Bory St Vincent, on the other hand, regards that opinion as erroneous which limits their aerial movements to a single sudden spring. "Je n'ai pas vu les exocets s'élever très-haut; mais je souvent observe qu'ils ne se replongeaient dans la mer qu'à une bonne portée de fusil au moins du point d'où ils étaient partis. Selon l'occasion, ils changent la direction de leur vol, et s'abaissent ou s'élèvent parallelement aux flots agités; ils ont enfin la faculté de voler d'une manière bien plus parfaite qu'on ne la leur suppose généralement."[2] The double chase of this unfortunate species was indicated by Duquesne so far back as 1690. "Ce petits animaux," observes that voyager, "n'ont nul repos, ni dans l'eau, ni dans l'air; dans l'eau, à cause des bonites, dans l'air, à cause des oiseaux qui fondent sur eux avec plus de rapidite que le faucon ne fond sur la perdrix."[3] Indeed, all voyagers, whether ancient or modern, have recorded the delight with which they witnessed these sudden emergencies; and Bosc in particular describes the flying fish as sometimes rising in hundreds, and even thousands, around his vessel, and darting over the waves in all directions, scouring away, as Coleridge has beautifully said in relation to another group of animals, "like a Tartar troop over the wilderness." We shall conclude this notice by observing that the flesh of flying fishes is savoury and delicate, and that they thus present another claim to the attention of the voyager.

At the end of the family of the Esocidæ is to be placed a genus which differs but a little from them, except in having long intestines provided with two cæca, and which will probably be formed into a particular family.

Genus Mormyrus, Linn. Body compressed, oblong and scaly; tail slender at the base, and enlarged towards the fin; head covered with a thick naked skin, enveloping the opercula and the branchial rays, and leaving for their aperture only a vertical cleft, a circumstance which has caused some naturalists to deny the existence of opercula, although they are as complete as in any other fish, and to assign to them only two branchial rays, although there are five or six. The opening of the mouth is very small, almost as in those Mammalia named anteaters, and the maxillaries form its angles. The teeth, which are slender and notched at the end, cover the inter-maxillaries and the lower jaw; while on the tongue, and under the vomer, there is a band of small and crowded teeth. The stomach is in the form of a rounded sac, followed by two cæca, and a long slender intestine always enveloped in a profusion of fat. The bladder is long, large, and simple. Many of these fishes inhabit the Nile, and they are ranked among the best which that river produces. It is conjectured that it was one of them which the ancient Egyptians held in religious veneration, and which they named *oxyrhincus*.

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[1] *Wanderings in New South Wales*, &c. vol. ii. p. 31.
[2] *Voyage aux quatre iles d'Afrique*, t. i. p. 83.
[3] *Voyage aux Indes Orientales*, t. i. p. 236.

Malacopterygii Abdominales. Siluridæ.

FAMILY III.—SILURIDÆ.

Is distinguished from all the others in the order by having no true scales, but only a naked skin, or large osseous plates. The inter-maxillaries, suspended under the ethmoid, form the edge of the upper jaw; and the maxillaries are reduced either to mere vestiges, or are lengthened into barbels. The intestinal canal is large, folded, and without cæca; the bladder large, and adhering to a peculiar osseous process; the dorsal and pectorals have almost always a strong articulated spine for the first ray, and there is very frequently an adipose fin behind, as in the Salmonidæ.

Genus Silurus. A numerous genus, known by its want of scales, the mouth cleft at the end of the snout, and, in the greater number of sub-genera, by the first ray of the pectoral being composed of a strong spine. This is articulated to the shoulder bone, in such a manner that the animal at pleasure can either draw it towards its body or erect it perpendicularly, in which case it becomes a dangerous weapon, and inflicts wounds which in some countries are considered venomous, doubtless because tetanus or lock-jaw sometimes ensues. The head of the *Siluri* is depressed; the maxillaries very small; and the covering of the branchiæ wants that piece which has been named by Cuvier the *sub-opercle*.

In some species (*Silurus*, Lacép. properly so called) there is only one small fin, with few rays on the anterior part of the back, but the anal is very long, and reaches nearly to the caudal. In others, more especially so named by Artedi and Gronovius, the small dorsal is without any apparent spine; the teeth on both jaws are like those of a wool card, and behind the inter-maxillary band of teeth there is a vomerian band. Of this kind of structure an example is found in *Silurus glanis*, L. which is the largest of European fresh-water fishes, and the only one of this extensive genus inhabiting the Continent. See Plate CCCIV. fig. 12. It is smooth, greenish black, spotted with black above, and yellowish-white beneath. The head is large, with six barbels. It sometimes attains the length of twelve or fifteen feet, and the weight of 300 or 400 pounds. As this creature is somewhat unwieldy in its motions, it does not pursue its prey, which consists of small fishes, but lies concealed among the mud, and seizes such unwary stragglers as happen to come within reach. It has occasionally been observed in the sea, but always near the mouths of rivers, and in such other situations as to leave no doubt that its appearance there is to be ascribed to accidental causes. The flesh is fat and sweet, and its lard has been employed in some places as a substitute for that of the hog. Sir Robert Sibbald, at the conclusion of his list of river fishes, adds, "Silurus sive Glanis;"[1] from which it has been inferred that this gigantic species may at one period have inhabited the Scottish rivers.[2]

A few fishes, found hitherto only in the Nile, differ from the *Siluri* in having their bodies compressed vertically, and by having a strong and denticulated spine to the dorsal. Their head is small and depressed, the nape suddenly raised, and the eyes placed very low—circumstances which bestow upon them a very singular appearance. They constitute the genus Schilbus. The Pimelodi of Lacépède are characterised by the body being covered only by a naked skin, without lateral armature. This definition, however, comprehends a great number of fishes, many of which present so many differences in appearance and structure, that it is necessary that they should be grouped in several subordinate genera. The first of these, established by Cuvier, and which he names Bagrus, has in each jaw a band of small crowded teeth, and behind those of the upper jaw a parallel band which belongs to the vomer. They admit of still further subdivision, from the number of their barbels and the form of their head. Among those having eight barbels, some have the head oblong and depressed; in others it is broad and short. Of such as are furnished with six barbels, the most remarkable have the muzzle depressed and broad, after the manner of the pike; while others have the head of an oval form, and its shagreened bones forming a kind of helmet. The Pimelodi, however, *properly so called*, have no band of teeth on the vomer, parallel to that of the upper jaw, but there are often some on the palatines. In the number of their barbels, and in the form of their heads, these fishes present still more numerous varieties than the *Bagri*. Thus, among such as have only a single band of teeth, some are observed to have the head helmeted, and a distinct osseous plate or buckler between the helmet and the spine of the dorsal. Such is *Sil. clarias*, Bl. xxxv. 1, 2. In others the buckler is united to the helmet, and forms only a single body with it, the helmet thus extending from the muzzle as far as the dorsal. In some instances the head is oval, clothed only by the skin, through which the bones do not appear; in this group the species have either six or eight barbels. In those called *cat-fish*, the head is naked but very broad, and their barbels also vary, according to the species, from six to eight. We ought probably to place here the *Mathemegh* of the Cree Indians (*Silurus felis*, Gm.?), described by Dr Richardson as found sparingly in the lakes that flow into the Saskatchewan, and more abundantly in the lakes and rivers to the southward. It is much prized as a rich food.[3] Numerous other modifications of structure are to be found in this extensive genus, of which the greater proportion of the constituent species have but recently become known to naturalists. Several have the muzzle elongated, and these lead to a group of still more remarkable conformation, viz.

Genus Synodontis, Cuv. In which the muzzle is narrow, and the lower jaw supports a packet of teeth much flattened laterally, terminating in hooks, and each suspended by a flexible pedicle; a kind of dentition of which no other example is known. The rough helmet, formed by the cranium of these fishes, is continuous, without any interruption, with an osseous plate, which extends to the base of the spine of the first dorsal; and that spine is very strong, as is likewise the case with those of the pectorals. The lower barbels, and sometimes also the maxillaries, have lateral barbels. The species are found in the Nile and Senegal, and are known to the inhabitants of Lower Egypt by the general name of *Schal*, while in the upper regions of the same country they are termed *Gurgur*. Their flesh is not accounted of any value. The Ageneiosi of Lacép. possess all the characters of the *Pimelodi*, but they are without the barbels properly so called. *Silurus inermis* (Bl. 363) affords an example.

Genus Doras, Lacép. Contains such *Siluri* as have a second adipose dorsal, and the lateral line defended by a row of osseous pieces, each relieved by a spine or projecting keel. Their dorsal and pectoral spines are very strong, and powerfully dentated. Their helmet is rough, and is continued as far as the dorsal, as in *Synodontis*, and the humeral bone forms a point behind.

Genus Heterobranchus, Geoff. Has the head provided with a rough, flat buckler, wider than in any other of the *Siluri*, because the frontals and parietals produce

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[1] *Scotia Illustrata*, p. 25.

[2] Fleming's *British Animals*, p. 198.

[3] *Appendix* to Captain Franklin's first *Voyage to the Polar Sea*, p. 724.

lateral plates which cover the orbit and the temple. The opercle is still smaller in proportion than in the foregoing genera, and the peculiarity observed by Geoffroy distinguishes them from all other fishes, viz. that besides the ordinary branchiæ, they have ramified appendages like trees adhering to the superior branch of the third and fourth branchial arch, and which appear to be a kind of supernumerary branchiæ. All the species pertaining to this genus are found in the Nile, Senegal, and a few of the Asiatic rivers. Their flesh is either of indifferent quality, or altogether unfit for food. This is not the case, however, with the *Sharmuth* or *Black-fish* (*Silurus anguillaris*, Hasselq.), which is common in Egypt and Syria, and constitutes in the latter country a valuable article for the table.

Genus Plotosus, Lacép. Is characterised by a second radiated dorsal, of great length, as well as the anal; and both uniting at the caudal, form a point, as in the eel. Their lips are fleshy and pendent; the throat armed anteriorly with conical teeth, behind which there are others of a globular form, which at the upper jaw pertain to the vomer. The head, as well as the rest of the body, is enveloped in a thick skin, and the branchial membrane has nine or ten rays. All the known species are from the East Indies. They have eight barbels, and, behind the anus, the fleshy and conical tubercle common to all the *Siluri;* and there is, besides, a fleshy ramified appendage, the functions of which, though unknown, are probably remarkable. Some have the dorsal and pectoral spines dentated, and of considerable size. Such is *Platystacus anguillaris*, Bl. 373, while others have them concealed beneath the skin. The latter is the case with *Plotosus cæsius*, Buchan. xv. 44. Certain fishes referred by Linnæus to the genus *Callichthys*, and pertaining to that named Cataphractus by Lacép., have their bodies almost entirely cuirassed, so to speak, on its sides, by four rows of scaly pieces; and there is likewise on the head a compartment of these pieces. The extremity of the muzzle, however, is naked, as well as the under side of the body. The second dorsal has but a single ray in its anterior edge; the pectoral spine is strong, but the dorsal is slender or short. The mouth is but little cleft, and the teeth nearly imperceptible; the barbels, four in number; the eyes small, and placed on the sides of the head. These fishes can crawl for some time on dry land like the eel. In some the pectoral spine is merely rough, in others it is dentate, as in the majority of the *Siluri.*

Genus Malapterurus, Lacép. Distinguished from all the true *Siluri* by having no rayed fin upon the back, but only a small adipose one on the tail, and by the want of a spine to the pectorals, of which the rays are entirely soft. But one species is known with six barbels, the head not so thick as the body, which is inflated in front. It is the famous electric Silurus (*Silurus electricus*, Linn.) of the Nile and of Senegal; the *Raash* or *Thunder* of the Arabs, which gives electrical shocks like the *Torpedo* and *Gymnotus.* It appears that the seat of this faculty is a particular tissue situate between the skin and muscles, and which presents the appearance of an adipose cellular substance, abundantly supplied with nerves.

Genus Aspredo, Linn. *Platystacus*, Bl. Presents very peculiar characters in the flattening of the head, and the enlargement of the anterior part of the trunk, which principally results from the size of the humeral bones; in the proportional length of the tail; in the small eyes placed in the superior face; and in the inter-maxillaries being inclined under the ethmoid, directed backwards, and bearing teeth only on the hinder edge. In addition to these peculiarities, they are the only osseous fishes known which have no mobility in the operculum, because the pieces which ought to compose it are soldered to the tympanum and pre-opercle. Only a few species have come under the cognizance of naturalists, such as the *Silurus Aspredo*, Linn.; *Plat. cotylephorus*, Bl. 372; *Silurus hexadactylus*, Lacép. They have six or eight barbels, and it is remarkable, that when there are eight, one pair is attached to the base of the maxillary barbels; the four of the lower jaw are in pairs, one behind the other. Globules are seen on some of these fishes, which appear to be their eggs, adhering to the thorax by means of pedicles.

Genus Loricaria, Linn. Is so named on account of the rigid angular plates which completely cover the body and head, as with a coat of mail, and is further distinguished from such kinds as possess a somewhat similar defensive armour by having the mouth pierced under the muzzle. In position and mode of conformation, this mouth is most analogous to that of *Synodontis;* the inter-maxillaries are small and suspended under the muzzle, and the mandibular bones, which are transverse and separate, bear long flexible teeth, terminating in a hook.. A broad, circular, and membranous veil surrounds the aperture; and the pharyngeal bones are garnished with numerous teeth *en pavé.* The true opercula are immoveable, as in *Aspredo*, but two small, moveable, external plates seem to perform their office. The branchial membrane has four rays; and the first rays of the dorsal and pectorals, and even of the ventrals, are strong spines. There is neither cæca nor air-bladder. The species may now be arranged in two sub-genera, viz. Hypostoma, Lacép., which has a second small dorsal, provided with a single ray, as in *Callichthys.* Their labial veil is simply papillose, and bears a small barbel on each side. They have no plates under the belly, and the intestines, which are spirally convoluted, are as slender as a pack-thread, and twelve or fifteen times longer than the body. They are caught in the rivers of South America. *Loricaria plecostomus*, Linn., Bl. 376, and *Hyp. etentaculatum*, Spix, iv. are examples of this sub-genus. Loricaria, properly so called, has but a single dorsal in front: their labial veil is garnished on its edges with many barbels, and sometimes covered with villosities; the belly is defended by plates, and the intestines are of moderate thickness. To this group belong *L. cataphracta*, Linn.; *L. rostrata*, Spix; *Rinelepis aspera* and *Acanthicus hystrix*, Id.

FAMILY IV.—SALMONIDÆ.[1]

The fourth family of the *Malacopterygii* of Cuvier is composed almost entirely of the Linnæan genus *Salmo*, and has in consequence received from modern Ichthyologists the title of Salmonidæ. It will remain, however, to future observation to determine whether the family shall take its title from the salmon, as typical of the form, or from some other group, leaving to the above-mentioned fishes the value of a sub-family only. As it is, the circumstance of the present Salmonidæ possessing a small adipose fin, placed between the dorsal fin and the tail, has been used in a light purely artificial, and too much consequence has been attached to it. Mons. Agassiz is of opinion that the Clupeæ should be added to them, as differing only in the want of this fin; while all the Salmones of Cuvier do not possess a true adipose fin,—that part being composed of rays in the genera *Serrasalmus* and *Myletes.*

The family, as it now stands, may be characterised by

[1] As an illustration of the Salmonidæ, we here figure (from Mr Griffith's *Animal Kingdom) Salmo Canadensis*, a North American species, beautifully spotted with blood red on a white circle. See Plate CCCV. fig. 1.

Malacopterygii Abdominales. Salmonidæ.

a lengthened form, the body covered with scales of no great size, and furnished with two dorsal fins. The first dorsal fin is composed of soft rays; the second, generally of a fatty substance, resembling a fold of the skin, is usually of small size. The tail is remarkably powerful, acting as an elastic lever, and, as usual, constitutes the principal organ of locomotion. The margins of the jaws are formed by the maxillary and inter-maxillary bones, and, with the vomer and palate bones, are commonly thickly studded with teeth, strong, conical, and bending backwards. The maxillary and inter-maxillary bones constitute a single continuous arch, as in the higher animals. The pyloric portion of the stomach is furnished with numerous appendices connected with a pancreas. The swimming bladder is large and oblong, and opens into the gullet near the extremity. They are voracious, feed on insects, the less Crustacea, and small fishes. Many of the species are migratory, and approach the mouths of rivers, or ascend their streams for the purpose of spawning. In the breeding season they are marked by some appendage peculiar to the time, or by a change to colouring of more brilliant tints. They reach a large size. The flesh is well flavoured and wholesome.

In the modern arrangement it was found necessary to separate the SALMONIDÆ into groups; and in the present sketch we shall follow those proposed or adopted by Baron Cuvier in the last edition of the *Règne Animal*,—having deeply to regret that his decease should have prevented his great ichthyological work from advancing to a branch of the subject which still stands in need of revision, and which would undoubtedly have derived the most signal advantage from the exercise of his critical skill.

GENUS SALMO, Cuv. Edges of the upper jaws formed by the maxillary and inter-maxillary bones, which, with the palatine bones, vomer, and tongue, are armed with strong conical recurved teeth; rays of the gill-covers from ten to twelve; tail very powerful; posterior dorsal fin adipose; ventral fins placed opposite the anterior dorsal, anal opposite the posterior; vertebræ from fifty-six to sixty. The male fish has the nose elongated and the under jaw hooked during the breeding season. The silvery colours change to gray and red. The species inhabit the sea and fresh waters. Some migrate at the breeding season; all spawn in shallow streams, and both sexes assist in forming the spawning bed. They inhabit Europe, Asia, and America.

The fishes which constitute this genus are of great importance, and are by far the most esteemed and valuable of all those which inhabit the fresh waters. The value of the fisheries, with the number of men engaged in them, is very great, and the expense of the materials which are consumed in the capture of one or two species is immense. In Britain they are mostly consumed in the great towns, either in a recent or prepared condition. In the north of Europe and America numbers are salted or otherwise cured for exportation. At the commencement of the genus is generally placed

Salmo salar, or *common salmon*, a species which likewise occupies the foremost place in the estimation of both sportsman and epicure. The salmon is a fish of great elegance, combining a form fitted alike for strength and swiftness; and its depth and thickness, while in good condition, are so proportioned to its length as at once to convey the idea of a pleasing symmetry. The body above is of a rich bluish or greenish gray, changing below to silvery, sprinkled above the lateral line with rather large sub-cruciform black spots, a few of which at the shoulders generally extend below the line. The characters which distinguish it from its British congeners are the different form of the opercular bones, which show a rounded outline to the posterior edge of the gill-covers, the longest diameter of which to the nose would be in a line through the eye, while in all the other British migratory species the same line would pass much below the eye. The black inner surface of the pectoral fin is nearly a constant mark. The tail is forked in the young state, but fills up to a nearly square outline in the adult, in which the width between the extremities is proportionally wider than in *S. eriox*, the only migratory species which attains a weight at all approaching that of the salmon. The outline of the scales also presents distinguishable differences.

The common salmon inhabits the seas around Great Britain, and extends to the north of Europe and to Asia; but it is not properly ascertained that those found in North America are identical. Its true abode may be called the sea; for as soon as it has entered the rivers it begins to deteriorate in condition, the scales lose their brilliant silvery lustre, and the flesh becomes soft and pale. It is drawn to the fresh waters by that natural instinct so wisely implanted for the purpose of its reproduction, an instinct which enables it to stem the current of the most rapid rivers, to ascend precipitous falls, and to pass through weirs and obstacles of human intervention, which no other power could overcome. This desire of looking for a suitable place in which to deposit their ova is their sole reason for thus seeking the "rivers of water," the torment of sea insects, or other causes which have been assigned, having no influence. This may be at once understood from the fact of the barren fish continuing their usual haunts along the coast, while a great many do not for a year at all enter the fresh waters. It is during this run to the proper spawning beds that the greatest numbers are captured, either by weirs, cruives, nets, or the rod; and it is then also that the sporting angler alone can ply his vocation, almost all attempts to angle the salmon in salt water having yet proved unsuccessful. Many fish far advanced with spawn are by these means destroyed; for unfortunately the most advanced are the most voracious, and a needy fisherman looks more to his present gain than to an expected produce of another year. It would be well and wise if the net fisheries of this valuable species were more confined to the tide-ways, where, in some estuaries, they are extensively carried on (as well as in the rivers) by means of stake-nets. These are so constructed as to intercept the fish entering the rivers, all in a high state of condition, and are sometimes wrought to such an extent as to employ several miles of netting.

Salmon generally delay entering the rivers in great numbers until the streams become somewhat swollen by rains, although in the larger rivers there may be said to be a limited daily run. When the flood has fairly mingled with, and to a certain extent has saturated, the estuaries, the rush of fish is often very great, especially if there has been a continued tract of dry weather. In the latter case they collect at the mouths of rivers, and are seen and often taken in vast numbers; but they do not then attempt an ascent, deterred perhaps by the clearness of the stream, or by some instinctive feeling that the water would yet be deficient to carry them through. As the *fresh* approaches, however, an increased activity may be perceived; and, as far as we can judge, the change is probably indicated by the nostrils receiving a sense of the mixture of the waters, by means of the large ramification of nerves with which they are supplied; and to this same sense may perhaps be attributed the singular fact of the greater proportion of salmon returning to the very streams in which they were spawned. The fish, on entering the river, rush forward as long as the flood continues, seldom resting in their course during the time that the water continues discoloured. From ten to twenty-five miles daily is the rate, as far as can be ascertained, at which they are supposed to travel.

In their more lengthened courses, where the rivers are deeper and the interruptions less frequent, the rate at which salmon travel is probably much more rapid. We know indeed little as yet regarding the identity of species between our own and those of foreign regions, but if, as some suppose, our salmon attains to the lofty Cordilleras of South America, by means of the mighty Maragnon, then it must run a course of about 800 leagues. Bearing in mind, however, that the salmon is a truly northern fish (that they occur in *some* abundance in the arctic regions, may be inferred from the fact, that Commander Ross, during his recent voyage, took *three thousand three hundred and seventy-eight* at one haul, in the month of July; and that his uncle Sir John obtained a *ton weight* of salmon from an Esquimaux, in exchange for one or two knives!), and also remembering those laws of distribution which regulate, and, with a few exceptions, circumscribe, the localities of living creatures, we think it more than likely that the South American salmon belong to another species. We know, however, that our common kind (*Salmo salar*) makes its way by the Elbe into Bohemia, and through the Loire as far as the environs of Puy, in the ancient Velay. We also know that it works its way up the Rhine, and visits a portion of the rivers of Switzerland, although the irresistible torrent of the Falls of Schaffhausen prevents its ingress to any part of the basin of the great Lake of Constance. But we feel less assured of its occurrence in the Persian Gulf, or of the identity of the species found in the Caspian Sea. Neither can we credit that it advances unrepelled by the gloomy terrors of a subterranean journey, and that salmon from the Gulf, adorned by the fanciful Persians with rings of gold and silver, have been found in the Caspian. The non-existence of the supposed communication is of itself a pretty sufficient barrier, even did no other exist in the laws of nature, and were light and atmospheric air dispensable.

In our lower and clearer waters, however, they travel at a much slower rate than that above alluded to,—resting for some time in the pools by the way, and now and then taking a regular *lie* in some chosen spot, which they will return to daily as long as the river continues unfitted for their progress. Upon the least accession, however, to the water, either directly or from some swollen tributary, they are again upon the alert; and it is often felt by them several hours before the quickest or most experienced human eye can perceive a rise upon the river. Having ascended to a considerable height, they remain more stationary, and proceed more slowly with the subsequent floods, till the spawn increases in size. This increase, if not influenced by, is at least so connected with, the commencement of the colder weather, as then to proceed at a more rapid rate. As the spawn advances, the symmetry of the form is disfigured; the female becomes disproportionately large, the colours lose the brightness of their silvery tints, and become dull and gray. The male becomes thin upon the back, the nose elongates, and the under jaw turns up in a large and strong hook, which enters a hollow in the nose before the inter-maxillary bones. The colours and markings become brown and red, those on the head and gill-covers being particularly brilliant, and disposed in lines almost like the marking of a *Sparus*.[1] In this full breeding dress the male and female seek some ford or shallow stream, and commence to excavate a trench or furrow (chiefly by the exertions of the female). In this the spawn is deposited, and impregnated at the same time, and finally covered with gravel by the exertions of the fish. The furrow is generally from six to nine inches in depth; and when the spawn has appeared to be covered beyond that depth, this has occurred from some other circumstances,—such as the stream or floods having carried downward additional masses of gravel, &c. After this great effort has been accomplished, both sexes are reduced to a state of remarkable emaciation. The elongated nose, and hooked jaw, and brilliant colours, are almost immediately lost; the old scales are cast, and the fish retire to some pool to regain their strength and complete their new clothing. They finally redescend to the sea by easy stages, where their former condition and silvery lustre are regained, their strength invigorated, and all their functions so repaired as to enable them ere long to renew their visit to the flowing streams, again to multiply their race.

The ova continue covered by the gravel during the winter, and begin to vivify from about the end of March to the commencement of April. The fry remove from under the gravel when nearly an inch in length, with the ovum still attached; and at this period, if the spawning bed or furrow be turned up, it will appear in motion. When disengaged from the ova, the fish increase in size most rapidly, and about the end of April and during May commence and perform their first migration or journey to the sea. At this time they are from four to six inches in length, of a greenish gray above, silvery below, the scales extremely delicate and very deciduous. From the time they reach the sea, for two months or ten weeks, we lose sight of them, and can only infer their growth from the fact, that after the lapse of that period we find them again ascending the rivers with a weight of from two and a half to four pounds. They are then known under the name of *gilse* or *grilse;* and their size, as they ascend from the sea, increases with the advance of the season. The gilse which thus ascend spawn during the ensuing winter, and are then entitled to the name of *salmon*. Descending in a weak state (as before mentioned), they return again in the summer of the following year, as fish of from ten to fifteen pounds weight, according to special circumstances. A third year would still increase their weight, as would several ensuing seasons, till the attainment of an enormous size. Pennant, for example, mentions a salmon which weighed seventy-four pounds; and although we now regard with something of wonder a fish which weighs even the half of that amount, yet there is no doubt that not many years ago salmon of forty pounds were much more frequent than in these degenerate days.[2] The absence of salmon of the largest class from many of the Scotch rivers, where they formerly abounded, is in fact owing to the injudicious perfection of our fisheries, which occasions the constant capture of the species in the state of gilse, or other early condition; and the chances are by consequence greatly against any individual escaping the various dangers by which it is environed, for such a succession of years as is likely to admit of its attaining to its full dimensions. The destruction by poachers in the higher parts of the rivers, of the large enfeebled *kelts*, or fish which have completed their spawning operations, is also extremely prejudicial; for these individuals (almost utterly useless as food at the time alluded to) would, if allowed to descend to the salubrious sea, ere long revisit their native streams, greatly increased in size, and full of health and vigour.[3]

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[1] In this state it has received from Cuvier the erroneous name of *S. hamatus*, as if it were a distinct species. See *Règne Animal*, t. ii. p. 303.

[2] We observe that a salmon above fifty pounds weight was recently taken at the mouth of the Leven in Dumbartonshire. The general capture this season (1835) has been very great in Scotland. Nearly 800 were taken at one haul in a bay of the island of Islay; and our calculation, from accurate data, is, that for some time past about a *hundred thousand salmon* (including grilse) have been shipped in Scotland *weekly* from our eastern ports alone. A friend of our own lately saw a salmon of sixty-one pounds weight on a fishmonger's stall in London.

[3] The reader will consult with advantage the *Parliamentary Reports* of evidence taken by a Committee of the House of Commons,

Malacopterygii Abdominales. Salmonidæ.

Salmo eriox, or *bull trout*, is another British species which attains a large size, and does not seem as yet clearly described as inhabiting any of the other European waters.[1] It reaches a weight of twenty-five pounds. It is thicker in proportion to its length than the salmon; the fins are much more muscular; the tail particularly so, and perfectly square at the end in all the stages of growth, while the distance between the two extremes of the web is smaller proportionally than in any of the other species. The head is larger in proportion than that of the salmon of a similar weight, and the opercular covering is more lengthened. The toothing is very strong. The general colours are, above greenish gray, the lower parts silvery white; the body above the lateral line being thickly covered with large cruciform black spots. In the breeding dress they assume a much blacker tint than the salmon, and want much of the red markings. All the under parts, jaws, and cheeks, become blotched with deep blackish gray. The flesh is of a yellowish tint, and is coarse, except in the young state; it has the least flavour, and is consequently less esteemed in the market than any of the other species. The hook of the under jaw of the male does not become so elongated as in the salmon. The old fish commence to enter the rivers about the end of July, and appear to deposit their spawn and return to the sea about a month earlier than the salmon. The young fish, of from two to three pounds weight, and in this state known as *whitlings*, enter the rivers about the beginning of June. In all its states it is a very powerful fish, and feeds voraciously and indiscriminately. When hooked it springs repeatedly from the water, and runs (to use an angler's expression) with extraordinary vigour to free itself. The river Tweed and its tributaries are among the principal localities for this fish. It occurs also, though more sparingly, in some of the rivers of the Solway, but appears to be rare on the west and north coasts of Scotland.[2]

Salmo trutta and *albus*.—These fish have been by most modern Ichthyologists described as distinct. The characters of each, however, are extremely difficult to determine; and it is most probable that they will both be found to merge into one species, entitled to the name of *Salmo trutta*. Both fish are very abundant, and are taken in great quantities in the Solway and its tributaries, and along the greater part of the west and north coasts of Scotland. In the first-named locality, they bear the name of *sea trout*, *herling*, and *whitling*; in the two latter, of *white trout* and *finnock*; and being transported to the markets of our metropolis, they receive the additional name of *salmon trout*. Thus we may easily conceive the immense confusion that may and has arisen from the use or abuse of provincial names. Along the south-east coast of Scotland they appear less abundant; but this may arise from the larger mesh employed in the nettings. The Tay and the Forth supply the Edinburgh market. In its largest state, or as known under the specific title of *trutta*, it enters the rivers from two and a half to six pounds weight in the end of May. It is of an elegant form, and possesses all the symmetry of the salmon. The head is small, the back remarkably broad when viewed from above; the tail slightly forked, and wide at the extremity of the web; the colour above greenish, inclining to bluish-gray, lower parts of the clearest silver; body above the line spotted, as in *S. eriox*, with large, deep-black spots, but generally much fewer in number. The flesh is pink, richly flavoured, and much esteemed for the table. It ranks next to that of the salmon, and by many is esteemed more delicate than even that prized species. The *S. albus*, or smaller and younger state in which it is found, is very nearly of the same proportion, form, and colours. They approach the mouths of the rivers in the end of July and commencement of August, in immense profusion, and immediately enter the fresh waters, where an angler may take almost any quantity without the exercise of great skill. In the north they form a perquisite to the taxmen or kayners of the salmon fisheries,—above a thousand being sometimes taken at a sweep of the net. In the Solway they are taken in equal abundance in houses of the stake-net, covered for the purpose with net of a small mesh, and are then carried to the various country markets, and during the height of the run to the villages, in cart-loads, for sale. The flesh of this smaller fish (whether species or variety, as the case may be) is also pink, and delicately flavoured. Its food is likewise the same as that of the larger kind; in the sea small Crustacea (*Talitrus locusta* being a favourite and common food),—in fresh water aquatic insects, worms, minnows, or other small fish. They appear also to spawn rather earlier than the salmon, and after the same manner. The colours of both sorts during the breeding season are deep-grayish black, slightly tinted with brown in the males; and at this time they offer a most marked contrast (being black and lean) to the symmetrical form and brilliant silvery tints of their perfect condition.

The preceding species (*S. salar*, *eriox*, *trutta*, and *albus*)—whether three or four in number, is still, as we have said, a dubious point—appear to be the only migratory salmon yet known to inhabit the waters of Great Britain. On the Continent of Europe, however, we have the

Salmo hucho, said to be peculiar to the waters of the Danube, but most probably migratory to the Black Sea, and certainly not a native of the British waters, though inserted in many of our lists. It is a fish of extraordinary power, attaining to the weight of sixty pounds; and is of more lengthened proportions than the common salmon. The flesh pale coloured, and rather coarse. The young have large transverse bands upon the back and sides; with age these break up into spots, and gradually disappear, till the ground colour becomes uniform, and is only broken by the ordinarily black or violet spotting. In America, again, we have in this division the

Salmo Hearnii, or *Copper-mine River salmon*. Above olive-green, pale on the sides, and shading into bluish white, marked with longitudinal rows of flesh-red spots, largest on the sides, where they are about the size of a pea. The scales, like those of the other salmon of America, are much smaller than those of the European species, and in this fish they possess peculiar lustre. The teeth are weak and few, their size inferior to those of the common salmon. Their flesh is red. This fish is abundant during July and August, below the falls of the Copper-mine River.

The migratory salmon are distinguished from those which inhabit only the fresh waters by the clear grayish blue of the upper half of the body, and the brilliant silvery lustre of the belly and lower parts. Among those

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appointed to investigate the subject of the salmon fisheries. We beg also to refer to Dr Knox's Observations, published in the 12th volume of the *Transactions of the Royal Society of Edinburgh*.

[1] The *young* is the *whitling* of the Tweed, the *Berwick trout* of the London markets; but the *whitling* of all our Scottish rivers is not necessarily the young of *S. eriox*, in as far as provincial names are sometimes variously applied. In regard to the more scientific synonyms of this species, we know not what degree of relationship its adult state may bear to the *Truite de Mer* of the French,—*Salmo Schiefermullcri*, Bloch, 103.

[2] We have no doubt that the *Norway salmon* of the Sutherlandshire fisheries is identical with the above-described species,—that is, with the full-grown *Salmo eriox*.

Malacopterygii Abdominales. Salmonidæ.

which in common language receive the appellation of *trouts*, the colouring is more varied and of brighter tints, in which yellow and orange predominate, changing to various shades according to locality. The best and most familiar example is

Salmo fario, or *common trout*. This lovely fish is most extensively distributed over the whole of Northern Europe, being found in every burn and tarn, in every lake and river. It may be also said to be one of the most pleasing in its appearance; and, when newly taken in "golden glory" from some translucent stream, is exquisitely beautiful. The variation of the tints of the ground colour is infinite; yellow, however, is the most predominant, varying to the most brilliant orange; while at other times the ground colour of the body runs from a dark-greenish black to violet, in most instances numerously spotted with black and red. Sometimes, however, the black is alone present in the form of large round spots, placed in a pale circle, but in all cases beautifully relieved, and breaking up the uniformity of the other colours. In a few instances the spots have been observed to be wanting altogether. One cause of the variation in the trout, is the difference of food; and, according to every information we possess, those which feed on fresh-water shells, *Gammari* (screws, or fresh-water shrimps, as they are sometimes called), are of the most brilliant tint, and also of the finest flavour, with a decided pinkness in their flesh. Those feeding on the ordinary water insects are next in brilliancy and flavour, while such as live chiefly upon aquatic vegetables are dull in colour, and of soft consistence. This is further confirmed by the trout in *stews* being always finished, or *fed off* as it is called, on the foresaid Gammari, collected often from a distance. It is only in this way also that we can account for the variation in the appearance and flavour of trout found in two adjoining bays of the same lake. The individuals, in fact, do not appear to stray to any distance, but seem to be satisfied with whatever food is found within a limited district, and which of course will be in many instances of a peculiar and local kind. It is also true, that the colours of trout accommodate themselves to the tint of the water, and to the prevailing *tone* of the bottom, whether of rock or gravel, or of softer substance; and so constantly is this the case, that an experienced and observant angler has little difficulty in accurately predicating the general aspect of the fish of any lake or river. The presence of moss, so frequent in alpine districts, has invariably the effect of deepening the tints, particularly the shades of green and yellow.

In form this fish, when in perfect condition, may be said to be nearly symmetrical; the head only being sometimes rather large in proportion to the body, when considered in relation to what we regard as the *beau ideal.* The fins are of moderate strength, those of the body assuming a variation of form, from a rounded to a lengthened extremity. The tail is almost always forked; the fins are always coloured, that is, never of the transparent whiteness observable in the migratory species; and their tints are generally of a paler shade than those of the corresponding parts of the body. The anal fin is often bordered on its lower surface with white. The scaling is proportionally less than in the migratory kinds. The toothing is in general strong, and very prominent on both the tongue and vomer.

The average growth of the common trout, taking the species generally, may be stated at about a pound, and certainly not more than a pound and a half. In almost all rivers, fish weighing beyond this may certainly be found; but they are comparatively uncommon. Individuals from two to six pounds weight are occasionally taken, even in what may be termed a "wild state." In ponds or stews, again, they reach a much greater size, but cannot be said to be in the natural condition of unenclosed fish. The Thames trout seem to reach most frequently the largest size, being short compared to their length, but of great thickness and well flavoured. Two were lately taken, the one of eleven, the other of fifteen pounds weight. The lakes in the north of England produce trout of very fine quality, and which are often passed off for char. Loch Leven, too (of which the barren isle and now dismantled castle are famous in history as the prison-place of the beautiful Queen Mary), has long been celebrated for its breed of trout. These, however, have fallen off of late considerably in their general flavour and condition, owing, it is said, to the partial drainage of the loch having destroyed their best feeding ground, by exposing the beds of fresh-water shells, which formed the greater portion of their food. Farther north (as in Sutherlandshire) the immense multitude of lochs produce a corresponding abundance and variety of trout. Of these, however, only a few are of superior quality; but these few may assuredly vie with the trout of any country in the world.[1] Another large species, occurring in the British waters, and not yet distinctly known elsewhere, is the

Salmo ferox, Jardine. This species reaches a weight of twenty-eight pounds, and is of very great power compared with its size. The characters which distinguish this fish from *S. fario* are the great size which it attains in a natural state, the large proportional size of the head, the square extremity of the tail in all the stages of its growth, the relative position of the fins, and the number of rays in the dorsal, which vary from 2—11 to 4—11. The external skin or covering of the scales is also extremely tough; and there is a difference in the form of the scales of the lateral line. In colour the upper parts are generally of a deep purplish brown, shading into purplish gray, and finally, on the lower parts, to greenish or grayish yellow, more or less tinted with orange. The spotting is large and not numerous, and consists of black spots placed in a pale circle, and of large pink spots with a similar light area. These extend over the gill-covers, upper fins, and often over the tail itself. A variety occurs in Loch Loyal, in Sutherland, above purplish brown, beneath blackish gray, the whole body spotted over with dark sepio-coloured spots, of a smaller size on the lower portions. *Salmo ferox* appears to be entirely confined to the lakes, seldom ascending or descending rivers, or wandering in and out of them, and never migrating to the sea. When spawning, it ascends for a short way up the rivers or streams which run into the lakes, but never, as far as yet known, descends those which run out of them. It inhabits, among the English lakes, Ulswater; but does not there reach a size above ten or eleven pounds. In Ireland, as far as we can yet learn (specimens having not yet reached us on this side of the water), it is found in Loch Neagh and some other large lakes; and in Scotland we have taken it in Loch Awe, Loch Laggan, the upper end of Loch Shin, and Lochs Loyal and Assynt. It is a fish of remarkable ferocity, and as great an enemy to its smaller companions as the pike. It may be taken by night lines, or by strong trolling tackle, baited with a small trout, and will return a second and third time to the bait, even after it has been dragged for forty or fifty yards.[2]

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[1] We may here note the existence of a strongly marked and peculiar variety, called the *gillaroo trout* of Galway. It is remarkable for feeding on shell-fish, in consequence of which (as is supposed) the coats of the stomach acquire a great degree of thickness,—from which peculiarity it is sometimes called the *gizzard trout*.

[2] For a detailed account of the mode of fishing for this and the other species, see our article ANGLING, in the third volume of the present work.

Malacopterygii Abdominales. Salmonidæ.

S. salmulus, or *parr*. An abundant species in all the clear running streams in England and Wales, and the south of Scotland; but in the last-named country it begins to decrease, so as to become comparatively rare, towards the north. It frequents the clearest streams, delighting in the shallower fords having a fine gravelly bottom, and hanging there in shoals, in constant activity apparently both day and night. It is found during the whole year in the rivers; but its breeding has not yet been discovered, though the fish are found in such a state as to shed their spawn when handled, close to the verge of the tideway. It is a remarkably beautiful little fish when newly taken from the water, above of a greenish gray, beneath white inclining to yellowish, the sides marked with dull bluish patches of an oval form, and the body above the lateral line sparingly spotted with brownish-black and red. On the gill-covers there are two black spots, one of which is often indistinct. This fish has been always confounded, and still is so, with other species. Many maintain it to be the young of the salmon, while others insist that it bears that relationship to the common trout. The presence of the dark finger-like markings upon their sides has naturally assisted in this confusion. These marks, however, are distinguished by being always narrower in their form than in the trout or young salmon.[1] Besides the external aspect being so distinct that any observer will without difficulty separate them when seen together, the whole skeleton of our present species is more delicately formed, as are also the teeth. The form of the opercular bones is likewise different, and the length of the maxillary bones is much less in the *S. salmulus*, or parr, showing a very marked difference when the open mouths of the different fish are exhibited together. Another distinction is, the great width and power of the pectoral fins, evidently a special provision, as the principal organ of support in those rapid streams where this little fish is almost always found.

Although the history of the parr is still, in truth, obscure, we certainly deem ourselves authorized to state that it is not the young of the salmon. It may be found in rivers throughout the year, and is more especially abundant during those midsummer months in which the acknowledged young of the salmon is unknown except as a fish returning from the sea. The most characteristic and irrepressible instinct of the latter seems to consist in its descent to the sea a few weeks after exclusion from the egg; and if our summer parr is also the young of the salmon, the fact presents a very rare and remarkable example of different individuals of the same species varying in their instinctive habits. The occurrence of parr in rivers so long after midsummer, and the entire disappearance of *smoults* (as the young salmon are sometimes called) anterior to that period, is a main argument in favour of their being distinct kinds; and we cannot get over the difficulty by simply asserting, that such as go down to the sea early are parr, and that such as go down late are parr also. It is admitted that the ova of salmon are hatched in spring, and that the growth of the young (by whatever name we choose to call it) is extremely rapid. Now, as nobody ever finds a parr above a few inches long (six inches is a large one), and as by the end of summer they must be several months old, how can we (in the belief of their being young salmon) reconcile their imputed age with their actual dimensions?[2] Still more difficult will it be to explain, in connection with that belief, how the brood which has descended seawards in the spring should, after the lapse of the same period, be found in their native rivers weighing many pounds.

The preceding are all the species belonging to our present group which have been yet ascertained to inhabit the waters of Britain. On the Continent of Europe we have the *S. lacustris*, Linn., found in the lakes of Lower Austria, and in the Rhine above Constance, and reaching to an enormous size.[3]

In the northern parts of North America, according to Dr Richardson, trout abound in every lake and river. In the *Appendix* to that gentleman's first expedition under Captain Franklin, the different varieties are all placed under *S. fario*, or common trout. It is doubtful, however, whether that species exists at all in America; and several species entirely distinct will be described in the third volume of the *Northern Zoology*, which have much of the colouring of some varieties of the European trouts, but differ remarkably in the smallness of the scales.[4] Specimens of forty pounds in weight were seen; and in Lake Monito they were said to attain the weight of ninety pounds.

Another small group, which has hitherto been placed among the true Salmones, contains the fish commonly known under the name of *Char*. They differ from the trouts in the very small and narrower form of the scales, in the more delicate toothing (the vomer furnished with a single minute tuft at the tip, instead of being armed for its whole length), in the remarkably brilliant change which takes place during the season of breeding, a change very much more completely developed than in any of the other

[1] We would also suggest, as a good logical argument against the fact of *S. salmulus* being the young of the common salmon, that it is frequent in streams where salmon are scarcely ever seen. "What a pity it is," observes the Rev. George Low, "that I am almost obliged to deny the salmon a place in the Orkney zoology; yet true it is, that this noble fish is so seldom got here, that it is considered as a *wonder* when one is thrown ashore, or runs so far up one of our burns as to be taken. I have not heard of above three or four instances of salmon being taken in Orkney, three of which (if they were all salmon) were killed and brought on shore by the otter from the sea, and picked up by the country people, and a fourth which stuck in a mill-wheel, and was caught by the miller." The same writer, under the article *Parr*, observes, "Pretty *frequent* in the shallower lakes and clear burns, though not in such numbers as I have observed them in Scotland." (*Fauna Orcadensis*, pp. 220 and 223.) The reader will also bear in mind, that as we advance northwards in our own island, the parr becomes scarcer, the salmon more abundant,—and that while in the icy streams of the arctic regions the former has not yet been detected, the latter swarms in (elsewhere) unequalled numbers. It is scarcely worth while to allude to the opinion maintained by the late Sir Humphry Davy and others, that the parr is a hybrid or mule between the trout and salmon!

[2] We yesterday (14th September 1835), while angling in the North Esk, above the beautiful residence called The Burn, in Kincardineshire, killed about a dozen parr, two of which, measuring eight inches in length, were the largest we had ever seen. They were, however, as usual, spotted with red along the lateral line, and tinged all over the under parts, like trouts, with yellow. They exhibited no approach to the silvery character of the salmon, nor any departure from the usual aspect of the parr. The majority of the others were of the ordinary size, and some of them so small as to render it entirely incomprehensible—unless we are totally misinformed regarding the spawning periods of the salmon, and the time of its exclusion from the egg—by what process of reasoning they could be maintained to be the young of that fish.

[3] We are not yet in a position to judge conclusively regarding the identity or distinction of the great lake trouts of Switzerland, and our own *Salmo ferox*. "La grande truite du Lac de Genève (*Salmo lemanus*, N.)," says Baron Cuvier, "qui se trouve aussi dans quelques lacs voisins, a la tête et le dos semés de petites taches rondes et noirâtres sur un fond blanchâtre; *sa chair est très blanche*. Il y en a de quarante et de cinquante livres." (*Règne Animal*, ii. 303.) Now the gigantic tyrant of our Scotch lochs, to say nothing of other discrepancies, has the flesh of an *orange hue*.

[4] The greater number of the plates for the volume above alluded to have been for some time engraved, and their publication, with the corresponding descriptions, will afford an important addition to the library of the Ichthyologist.

species, and in their food consisting in a great measure of minute entomostraca. The best and most familiar example of this group is the char of England.

Salmo umbla, Agassiz,—apparently confounded by most authors, in consequence of its great variety of aspect, and synonymous, according to the above-named naturalist, with *S. alpinus* and *salvelinus*, Linn. It is abundant in the English and Welsh lakes, and in the greater number of those in the north of Scotland, when of any considerable extent; but more seldom seen there, from the absence of the practice of *netting*, and the general unwillingness of char to take a fly or bait. This fish is of great repute in the Lake of Geneva, and is also found in many of the alpine lakes of northern Europe. The common char reaches a considerable size, being sometimes taken in Britain above two pounds in weight, although the more usual weight is under three quarters of a pound. When in full condition, it is a fish of very great beauty, above of a grayish green, shading into the most delicate white on the lower parts, and tinted with a blush which is comparable to that seen on the breasts of some of the gull tribe when newly shot in spring. The body is sprinkled over with pale spots of a considerable size. In this state they remain in the deeper parts of the lakes, and are not frequently taken, although we doubt not they might be so were the practice adopted of hanging a herring-net in the deep water, instead of trying only the *winter* practice of hawling in shore. We ourselves caught them by the former method, in their prime *silvery* state, in Sutherland, during the month of June. On the approach of the breeding time, they seek the mouths of the small tributaries, and are taken in vast numbers at the very period when their preservation ought to be most strictly attended to, and when, in truth, they begin to fall off in their condition. At this season the colour of the upper parts is darkened, the fins are very rich, and the sides and belly become of a beautiful and brilliant red, the whole spotted with small marks of a paler tint.

Although we here follow our friend M. Agassiz in placing the two supposed species under one denomination, yet we willingly admit, and indeed particularly desire our readers to remember, that the history of the char, whether single or distinctive, has not yet been clearly made out.[1] We have already mentioned (in the article ANGLING of this work) that both kinds occur in Windermere, to wit, the char or case char (*Salmo alpinus*), and the torgoch or red char (*Salmo salvelinus*). These are usually thus distinguished:—the former by having the first rays of the ventral and anal fins white; the latter by having those parts plain, that is, of the same colour as the other rays. A remarkable distinction is also observable in their natural habits,—the case char ascending rivers, and spawning about Michaelmas,—the red char depositing its ova along the shores of the lake, and not till the end of December or the beginning of the year.[2] Let these facts be duly regarded in determining upon the distinction or identity of species. We hope ere long to investigate the subject steadily. In the mean time, to illustrate the character of colour, we shall extract from our note-book some memoranda made a few seasons ago, on six specimens of char (supposed to exhibit examples of the different varieties or kinds) selected from a hawl taken (by net) in Windermere on the 12th December. "No. 1 is a very beautiful fish,—the ground colour of the body pale ashy brown, somewhat lighter beneath the lateral line. The sides are richly marked with scarlet spots of different sizes; the whole of the under surface, from the pectoral fins to the tail, are brilliant scarlet. The fins are margined anteriorly with an opake white stripe, followed by a blackish-brown portion, passing posteriorly into deep crimson. The tail is blackish brown. The nose and front part of the head are marked by a black spot. The dorsal fin is of the same pale-brown colour as the back, slightly inclining to blue." This seemed a male. "No. 2 is a smaller fish, brown upon the back, and becoming gradually paler beneath; the abdomen and lower parts are dingy white, tinged with bluish colour. The ventral and anal fins are margined with white, their other parts flesh colour; the pectoral fins are reddish brown; the dorsal fin and tail blackish brown. The sides of this specimen are indistinctly marked with pale yellowish-red spots." This was a male red char, which appeared to have spawned. "No. 3 is of a blackish-brown colour, somewhat silvery, paler beneath the lateral line, and passing into yellowish white on the belly. The pectoral, ventral, and anal fins are brown, tinged with red. The dorsal fin and tail are brownish black. The upper part of the head is also black. The sides of this specimen are distinctly marked with numerous very pale, almost colourless, spots. No. 4 resembles the last described, but is smaller." These the fishermen called two *geld fish*, full grown and half grown. "No. 5 is a very dark fish, brownish black upon the back and sides, becoming, as usual, gradually paler beneath the lateral line. *The pectoral, ventral, and anal fins are distinctly margined* anteriorly with opake white; the central portion of these fins are brownish black, and their interior margins flesh colour. The upper part of the head is dark; the belly of a dingy red. No. 6 resembles the preceding, except that the under surface, instead of being dingy red, is pale reddish white. The *ventral and anal fins* are reddish brown, *margined anteriorly with white*. The pectoral fins are reddish brown, the dorsal fins are brownish black. Both these specimens are marked on the sides with obscure pale-reddish spots." These two fish were what the fishermen called *case char* (Salmo alpinus?), male and female,—yet the pectoral, ventral, and anal fins of the former, and the ventral and anal fins of the latter sex, were conspicuously margined with white, although that character is usually regarded as distinctive of the torgoch or *red char*. Perhaps the fact of the male having the pectorals so margined, while those of the female were of uniform colour, may be regarded as of some importance, as tending to show that the character itself is in some measure variable, and therefore insufficient to constitute a specific distinction.[3] Every angler knows that the under fins of the common trout are frequently margined on one edge with an opake line of milky white.

Although the art of angling is not immediately connect-

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[1] We understand that Mr Yarrell has obtained what he considers as a second species of char, from Wales, which will be described in an early number of his *British Fishes*. We are as yet, however, uncertain whether he makes out the two common kinds to be identical, and has discovered a new species, or whether his observations merely go to prove that the said kinds (as formerly supposed) are distinct from each other.

[2] The chief feeder or head stream of Windermere is composed of two branches, the Brathay and the Rothay, which meet a short way above the lake, into which they speedily pour their united waters. The Brathay is the left-hand branch (as we ascend from the lake), and draws its sources from the mountain vales of Langdale, reaching Windermere without any resting place,—while the Rothay has previously formed and flowed from two consecutive lakes, Grassmere and Rydal. The char, in ascending from Windermere to spawn, invariably turn to the left, and ascend the Brathay (though to no great distance), and as invariably avoid the lake-descended waters of the Rothay. They also spawn lower down the Lake of Windermere, at the mouth (or a short way upwards) of the stream called Troutbeck, which is also derived from the flow of mountain tributaries, without any lesser or intermediate lake.

[3] The specimens above alluded to are now deposited in the Edinburgh College Museum.

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ed with the science of Ichthyology, it is at the same time evident that the successful practice of that art necessarily illustrates the *food* of fishes, and therefore makes us acquainted with an important portion of their natural history. For this reason we insert the following memoranda, transmitted to us by Mr John Wilson, junior:—"The season for fishing char (with rod and line) in Windermere and Coniston commences about the end of May, and, I should say, is over by the first or second week in July. Trolling with a smallish minnow is by far the most successful mode of angling for this fish. It may, however, be taken with the artificial fly, the green and gray drake being the favourites. I killed three one day in May last with a small red *professor*.[1] A Bowness fisherman on the same day, trolling without intermission from six in the morning till six in the evening, killed *six and twenty*, being the greatest number that has been taken in Windermere, in a single day, by one person, for many years. In Coniston, where this fish is more abundant, I believe it is by no means uncommon to kill three or four dozen in a day. In regard to the size of char in Windermere, I should say they average three to the pound. I never saw one that was a pound. Billy Balmer told me that he once saw one that was a pound and a quarter, and that it was the largest ever taken in Windermere." In relation to the same subject, in a different locality, we may also add the following extract from another hand. "A small red char is found in Loch Achilty, Ross-shire, on the property of Sir George Mackenzie. It takes the fly greedily in warm, still weather, and, what is singular, during all the summer and autumnal months. I have captured eighteen in a forenoon in July,—raising many more. My flies were of various sorts, from a midge to one as large as a sea-trout fly. The water of Loch Achilty is singularly deep and transparent,—the soil is rich and loamy, and contains large quantities of imbedded wood,—black oak especially. It is supplied by numbers of minute streams, but has no visible outlet, being supposed to discharge itself subterraneously. The char found in it average eight or nine inches in length; we, however, caught one much larger. They rise with less velocity than the trout, and on missing the fly, unless injured, will return to the hook. In Strathglass there is a Loch Bruiach, where char are caught of a much larger size, but chiefly with the net,—except in the month of October, when, as our informant, the Rev. Mr Chisholm, told us, they may be taken in the shallows with the rod, but at no other season."[2]

On dissecting the char which we killed last summer in Sutherland, with a view to ascertain their food, we found the stomach usually empty, but the lower part of the intestine filled with green vegetable residuum. This we found to be the remains of the *cases* of aquatic larvæ (*Phryganidæ*), a few of which we discovered in a half digested state in the upper portion of the intestinal canal.

Following the preceding groups, or *Salmones* properly so called, Cuvier has placed the

Genus Osmerus of Artedi. Characterised by two rows of teeth on each palate bone, the vomer with a tuft on the fore part, the branchial membrane with only eight rays, the body without spots, and the ventral fins placed a little more forward than in the true salmon.

The best-known species is the *O. eperlanus*, Arted., *Salmo eperlanus*, Linn.; called *spirlin* in Scotland. It is a small fish of delicate but brilliant colours, clear green on the upper parts, passing into silvery on the sides and belly. It frequents the sandy bays at the mouths of rivers, which during the breeding season it ascends to spawn. It is abundant on the British coasts, and in many parts of Europe, and is taken in immense quantities, being much esteemed for the table.

Genus Mallotus, Cuvier. Characterised by the teeth, which are fine, closely set, and nearly concealed; eight rays to the branchial membrane; the body lengthened and covered with minute scales; the first dorsal and ventral fins placed beyond the middle of the fish, pectoral fins very large and round; the male during the breeding season with the scales of the lateral line furnished with lengthened appendages resembling hairs.

The only species is *M. Groenlandicus*, Cuv.; *S. Groenlandicus*, Bloch; *Capelan*, or *Lodde*. A small fish of from four to seven inches in length, the under jaw longer than the upper; above of a greenish gray, changing to whitish below; and remarkable for the structure of the scales on the lateral line, and the size of the pectoral fins. Abundant in the Arctic Seas, where it is taken in immense profusion when approaching the coasts to spawn, and is used as the principal bait for cod. A few are cured and brought to this country in barrels, where they are sold, and used as a *relish by the curious in wines*.

Genus Thymallus, Cuvier; *grayling*. Has been separated from the Guiniads, principally on account of the small scaling, and large dorsal fin. The species approach nearer in form, colour, habits, and food, to the trouts. They have the mouth with sides, that is, but slightly cleft, the teeth very fine, the body spotted, the branchial membrane with seven or eight rays. The stomach is very muscular. They inhabit rivers, and feed on aquatic insects, &c. England produces a beautiful species, commonly called the grayling, or

Thymallus thymus,[3] Salvianus. The grayling delights in clear rapid streams, and is found in many of those bearing that character in the more hilly or mountainous parts of England, particularly in Shropshire, Yorkshire, and Derbyshire,—reaching as far north as some of the tributaries of the Tyne in Northumberland. The European range of this fish seems extensive, if all the authors are correct in their designation. According to the *Flora Lapponica*, it is common in Lapland, and the viscera are there used instead of rennet, with the milk of the reindeer. It is also found in Siberia, in Prussia, and Pomerania. It is a very beautiful fish, above of a dusky bluish green, changing to a fine silvery gray. The lower edges of the scales are dusky, which gives the appearance of dark streaks running along the fish. The most marked feature is the dorsal fin, of very large size, and darkly spotted between the rays, in the form of transverse bands. The ordinary size is from a foot to sixteen inches in length, but instances of one or two from four to five pounds are recorded. By some authors the grayling is said to be a migratory fish, passing the winter in the open sea, and the summer in the fresh waters. This may, however, be the habit of the fish in some countries only, as in certain of the English rivers they seem to remain during the winter. This species, as far as we know, appears to be the sole example of the form in Europe; and it is only seen again in North America, in a very beautiful fish, the

Thymallus signifer, Cuv.; *Coregonus signifer*, Richards. This grayling was met with by the expedition under Captain Franklin, in the strong rapids and clear rivers to the northward of Great Slave Lake, where it rose eagerly at artificial flies, and afforded good sport from its

[1] A noted fly, so named in honour of the Professor of Moral Philosophy in the University of Edinburgh,—a gentleman who is said to conjoin with various other accomplishments, considerable skill in angling.

[2] From the manuscript of Mr Thomas Tod Stoddart, an ingenious angler, of the Scotch bar.

[3] So named from its supposed scent or flavour resembling thyme.

powerful motions in the water. Dr Richardson describes its sides as tinged with lavender purple, mixed with bluish gray, without streaks; the belly blackish gray, with several irregular white blotches; and there are five or six longitudinal rows of uniform quadrangular spots of Prussian blue on the anterior part of the body. There is a large blue mark underneath the lower jaw on each side. The dorsal fin, which forms a prominent feature in the fish, is of a blackish-gray colour, with some lighter blotches. Superiorly it has a narrow margin of light lake-red, and posteriorly it is beautifully ornamented with spots of Berlin blue. The ventrals are streaked with red, and with whitish lines in the direction of their rays. The scales are moderately large, and have no great lustre; their exterior margins are rotund and entire, or very slightly undulated, those on the anterior part of the belly being much smaller than the others. Of the fins the dorsal is the most extraordinary, being, according to Dr Richardson, "probably by far the largest in this genus." Its colours, as above mentioned, are beautiful, and, with its great size, form the chief ornament of the fish. It contains twenty-four rays; the first two or three are small; but the others increasing rapidly in height, as their origin is more posterior, become more and more branched, and cause the fin to play loosely like a flag over the posterior part of the body; the insertion of the fin occupies about one third of the length of the body, and the extremity of the posterior ray, which is five inches long, reaches as far as the adipose fin.[1] Specimens were taken sixteen inches in length. Another American grayling, found in the same northern localities, is the *Thymallus thymalloides*, Cuv.; *Coregonus thymalloides*, Richard. Resembles *Th. signifer*, but differs remarkably in the size of the dorsal fin. The body is compressed, and of a bluish gray, with purple reflections when moved in the light. The dorsal fin contains from twenty-two to thirty-four rays; but the posterior ones do not branch out in the same manner, and scarcely exceed the others in height; hence the fin has a very different aspect. It is about one inch high, has a dark bluish-gray colour, with several rows of spots, having purple centres and light-red borders. The usual length is eight inches.[2]

Genus Coregonus, Artedi. Distinguished from the last by the still finer teeth, larger scaling, and small dorsal fin; live in shoals in lakes or still waters, and only approach the edges during spawning time. Of delicate structure; feed much on entomostraca, and aquatic insects and their larvæ. Flesh white and delicate. The best-known British species is the Guiniad, or

Cor. lavaretus, *Salmo lavaretus*, Linn. Frequent in the lakes of Cumberland and Westmoreland, and also found in some of the Scotch lochs,—for example, Loch Lomond, where, as in the north of England, it is termed the *schelky*. According to the best authorities, it likewise occurs in those of Alpine and Northern Europe. It does not reach a very large size; the average may be stated from nine inches to a foot in length. The colours chaste and delicate, of a greenish gray above, changing to whitish, with a silvery lustre. The scales are of considerable size, and, when examined narrowly, are seen to be covered with minute black dots. It is used for the table, but is not so delicate as our other British species. It is known under the name of *fresh-water herring* in most of its localities.

Cor. marænula, found in the Swiss lakes and some other parts of the Continent of Europe, is a small species, of nearly the same colours as the last. This fish was supposed to be found in some parts of Britain, and the *vendace* of the Lochmaben lochs was thought referrible to it. When Scotch specimens, however, were shown to Mons. Agassiz during the autumn of 1834, he considered them distinct from the species known to the continental Ichthyologists as *C. marænula*, and the title of *C. Willughbii* was suggested for the Scottish kind. Continental specimens of *C. marænula* have not yet been received by us, and the distinctions, therefore, cannot at present be detailed. The *vendace* of Lochmaben, whatever scientific name it may ultimately receive, or whether it may be identical or not with the species inhabiting the lakes of Continental Europe, may be described as an interesting example of the genus. It is one of the most elegant, though of a small size, reaching from four to ten inches in length. The head is of an angular shape, and small compared with the size and depth of the body. The crown of the head is very transparent, and the form of the brain, which is heart-shaped, is seen through the integuments. This peculiarity is one of the first things pointed out to the stranger naturalist who visits Lochmaben to see this species. The eye is large and brilliant; the body rises gracefully to the back fin, and recedes with a gradual line to the tail; the under line is nearly straight from the gills to the ventral fin. The upper parts are of a delicate greenish brown, shading gradually into a clear silvery white; the dorsal fin greenish brown, the anterior edge much lengthened and pointed; the lower fins all bluish white; the tail much forked. They spawn about the commencement of November. The roe is minute and abundant, and of a bright orange colour. The flesh is white and rich, and highly prized as food; but as it requires almost to be *eaten on the spot*, it is not useful as a market commodity when transmitted to any considerable distance. The lochs of Lochmaben are the only authentic British habitat for this species.

Several other species inhabit the Swiss lakes, and are known chiefly from the works of the continental Ichthyologists, particularly M. Jurine, who has devoted a paper to the fishes of the Lake of Geneva. He there describes *C. fera* and *hyemalis* (the latter so named from its appearing only in winter); and Baron Cuvier notices a third from the Lake Neufchatel, under the title of *C. palæa*. In America several species are found in the lakes and rivers. The *white fish* of Dr Richardson seems to belong to the genus. It is the *C. albus* of Lesueur, and is called by the Cree Indians *Attihhawmegh*, a name corrupted to *Tittameg* by the traders. This fish attains a weight of from three (the ordinary size) to twenty pounds. It abounds in every lake and river, and is much esteemed as food, in many parts forming the sole article of diet for years together, without producing satiety. The stomach is of great thickness, generally filled with earth mixed with slender roots, and small white worms. It spawns in October. Another species is *C. quadrilateralis*, Richardson, of which the colour of the upper parts is intermediate between honey yellow and wood brown; the scales with a thin border of blackish gray round their exterior margins; the belly white, with a pearly lustre; the eye moderately large, the iris with a silvery hue; the mouth without teeth; the fins are yellowish; the adipose fin attached for its whole length. The stomach not thickened. The food small insects. Inhabits the Arctic Sea, and the small rivers about Fort Enterprise. The average size is about fifteen inches in length.

Under this division also appears to rank the *Inconnu* of Mackenzie and the Canadian Voyagers, although it is placed by Dr Richardson in the genus *Salmo*, under the name of *S. Mackenzii*. We therefore here record it as

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[1] Richardson, in the *Appendix* to Franklin's *Journey to the Polar Sea*, p. 711.

[2] *Ibid.* p. 714.

Malcopterygii Abdominales. Salmonidæ.

the *Coregonus Mackenzii*. The colour of the back and sides changeable from bluish to greenish gray, according as it is moved in the light. The belly bluish white; the scales sub-orbicular, four lines in diameter, and possessing much pearly lustre. From the form of the body, the size of the scales, the fineness of the teeth, and their distribution, this fish evidently belongs to the genus *Coregonus*. It reaches a weight of thirty or forty pounds. The flesh is white but agreeable. It is found in Mackenzie's River, and the lakes and streams which flow into it; also in Salt River, which, however, is its most southerly limit.[1]

GENUS ARGENTINA, Linn. The mouth small, depressed horizontally; no teeth on the jaws, but with a small tuft on the vomer, and having the tongue with teeth rather strong and hooked, as in the trouts. Six rays to the branchial membranes. The internal structure as in the trouts. The genus is composed of a single species, the

Arg. sphyræna, Linn. Found in the Mediterranean sea, and remarkable for the thickened coats of the swimming bladder, which, as well as the scales, is plentifully charged with that silvery secretion used in the manufacture of "*l'essence d'orient*," an article employed in the formation and lustre of false pearls. For this purpose the species is fished in great numbers along the coast of Tuscany. It is a small fish, scarcely exceeding four or five inches in length, of delicate tints,—the integuments being transparent, and giving a clear brilliancy to the colours. The upper parts are grayish, the sides and lower surface of a brilliant silvery lustre.

Following this fish, Cuvier adopts the genus CHARACINUS of Artedi, as a group to contain all the species of the Linnæan *Salmones*, which have only four or five rays to the branchial membrane, but as the form, toothing, &c. vary in most of these fishes, he has thought it necessary to subdivide them into subordinate genera. It is remarkable that many of them have the cæcal or pancreatic appendages, and at the same time the narrowing or girth of the air-bladder, which is seen in many of the Cyprini. The first subdivision is

GENUS CURIMATA, Cuv. In form the species resemble *Thymallus*. The teeth are, however, variable, and the divisions of this group may yet require examination. The number of branchial rays not exceeding five, must be remembered; some of the species, with the exception of that distinction, approaching very nearly to the genus just named. They inhabit the rivers of South America. As an example may be noted a new species, the *Curimata Gilbert* of Quoy and Gaimard. This fish somewhat resembles a small *Cyprinus*, but is distinguished, even on a superficial view, by the presence of the adipose fin. The scales are rather large in proportion; the upper parts are bluish gray, changing into silvery; the fins yellowish; the body appears spotted, or rather blotched, with indistinct dark markings, conspicuous only when placed in particular lights. This species was discovered in the fresh waters of Brazil, near the river Macaca, and appeared to prefer those places which were of a marshy character.

GENUS ANASTOMUS, Cuv. Characterised by combining with the form of the graylings a mouth cleft somewhat vertically, and furnished with fine teeth. It contains a single species, a native (it is said) both of South America and India, the *Salmo anastomus*, Linn. Is it not likely that two species are confounded here?

GENUS GASTEROPELECUS, Bloch. With the mouth placed vertically as in the last, but with the belly compressed. The ventral fins very small, and placed far back. The first dorsal fin placed above the anal, which is very long. Conical teeth in the upper jaw, in the lower sharp and cutting.

Gast. sternicla, Bloch, is a very small species, scarcely two inches in length, which inhabits the waters of Surinam. Its form is very much compressed, and sharply carinated beneath; above bluish gray; beneath silvery.[2] The fins gray, ventrals extremely minute, the anal extending nearly from them to the tail; the tail much forked.[3]

GENUS PIABUCUS, Margrave? Characterised by a lengthened form; a small head, with the mouth deeply cleft and armed with strong teeth. The body compressed; the belly carinated, but smooth; the anal fin much extended. The species inhabit the rivers of South America, and are carnivorous and voracious.

P. bimaculatus. About four inches in length by about two in breadth. Above brownish, lower parts silvery; fins pale yellow; on each side of the body beyond the gills an oval spot of black, with a similar one at the base of the tail. Inhabits the rivers of Surinam, and is esteemed as food.[4]

GENUS SERRASALMUS, Lacépède. The body compressed; the belly carinated, and toothed or serrated on its lower margin; the teeth triangular and cutting; some species with a concealed spine before the first dorsal fin.

Ser. rhomboides, Bloch. Above of a dusky red, marked with a few small scattered dusky spots; sides and belly silvery, the latter strongly carinated and serrated by a series of aculeated processes. The fins yellowish; tail terminated by a black border. Found in the rivers of Surinam, where it reaches a considerable size; feeds on fish and *water-fowl!* Two other species, *G. aureus* and *nigricans*, are figured in the work of Spix.

GENUS TETRAGONOPTERUS. This group was formed by Artedi, and after being thrown out by Ichthyologists, was re-established by Cuvier as a sub-genus. The form continues compressed, the anal fin much extended, and the teeth sharp and cutting; but there are two rows of teeth on the upper jaw, and the belly is neither carinated nor serrated, as in the preceding.

GENUS CHALCEUS, Cuvier. Characterised by the same form of the mouth, and the same cutting teeth, as the preceding fishes; but the body is of an oblong form, and neither carinated nor serrated beneath. The maxillary bones have three small round teeth. Inhabit South America. The species are *C. macrolepidotus*, Cuv., and *C. angulatus*. Spix.

GENUS MYLETES, Cuvier. Characterised by the singular form of the teeth, in the shape of a triangular prism, short, rounded at the corners, and with the upper surface so hollowed by mastication, that the three angles form three projecting points. The mouth small, with two rows of teeth on the inter-maxillary bones. None on the maxillaries. The under jaw with a single row of teeth. The form elevated; a spine before the vertical fins. The belly carinated and serrated. Inhabit America and Africa. Some of the species attain to a large size, and have the flesh well flavoured.

M. Hasselquistii, Cuv., *Salmo dentex*, Hasselquist, is found in the Nile. It is a fish of a lengthened form, with the dorsal fin occupying the position which corresponds to the space between the ventral and anal fins. The teeth are very strong. The colours above are brownish, with three or four indistinct longitudinal lines upon the sides; the under parts silvery.[5] *M. paco* is an American species.

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[1] Richardson in the *Appendix* to Franklin's *Journey to the Polar Sea*, p. 707.
[2] Schneider. [3] Shaw. [4] Schneider, Shaw. [5] Schneider.

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Genus Hydrocyon, Cuvier. Extremity of the muzzle formed by the inter-maxillary bones; the maxillaries commencing near or before the eyes, and completing the upper jaw. The tongue and vomer always smooth, but there are conical teeth on both jaws. A large sub-orbitary bone, thin and bare as the opercle, covers the cheek.

Certain species have a close row of small teeth on the maxillary and palatine bones, the first dorsal fin corresponding to the space between the ventral and anal fins. They are of agreeable taste, and inhabit the rivers of the torrid zone. To this group belongs the *Hyd. falcatus*, Quoy and Gaim. Above of a violet tint, beneath pale, but tinted generally with a shade of silvery. A silvery band extends the whole length of the body from the opercle to the tail, and at each extremity is marked with a dark spot. The fins gray at the base, and brown at the extremity. The eyes of a golden red. The scales small and deciduous. The specimens brought by Freycinet were from five to six inches in length. They were taken in Brazil.

Other species have a double row of teeth on the inter-maxillaries and lower jaw, a simple row on the maxillaries, and none on the palatine bones. The first dorsal fin is placed above the ventrals. A Brazilian species, *H. brevidens*, Cuv., exemplifies this minor group.

Others again have only a simple row of teeth on the maxillaries and lower jaw, but the teeth are alternately small and very large, especially the two second from below, which pass through hollows of the upper jaw when the mouth is shut. The lateral line is composed of scales of a larger size, and the dorsal fin is so placed as to correspond to the interval between the ventral and anal fins. *H. scomberoides*, Cuv. or *Cynodon vulpanus*, Spix, is an example of this peculiar form.

Another form has the muzzle pointed, the maxillary bones very sharp, and the inter-maxillaries and lower jaw furnished with a single row of very close, small teeth; the body covered with strong scales. A Brazilian species, *H. lucius*, Cuv. affords a characteristic example.

A fifth form has teeth only on the inter-maxillaries and lower jaw, and these few in number, but strong and pointed. The first dorsal fin is placed above the ventrals. A single species from the Nile, the *Characinus dentex* of Geof. (*Pois. d'Egypte*), presents the sole example of this limited group.

Genus Citharinus, Cuvier. Characterised by their depressed mouth, the upper edge formed entirely by the inter-maxillary bones. The maxillaries small and without teeth; the tongue and palate smooth; the adipose fin covered with scales, together with the greater part of the tail. The species inhabit the waters of Africa.

Some have the upper jaw only furnished with very fine teeth; the body elevated as in *Serrasalmus*, but without the carinated or serrated abdomen.

Salmo cyprinoides exemplifies this division of the genus. Others have on both jaws a number of teeth, thickly placed in several rows. These fish are more lengthened in their form, and appear to lead to the next genus. *Salmo Ægypticus*, Linn. serves as an illustration.

Genus Saurus, Cuvier.[1] Distinguished by its lengthened and cylindrical form, and by the large scales, which cover also the cheeks and opercles. The edges of the upper jaws are formed entirely by the inter-maxillaries; and on each, as well as on the palatine bones and the tongue, are numerous pointed teeth, which are wanting on the vomer. The first dorsal fin is placed much posterior to the ventrals, which are large. The interior structure resembles that of the trouts. They are very voracious.

This form is illustrated by the *Salmo saurus* of Bloch and Linn., a native of the Mediterranean; above of a greenish blue, varied with numerous narrow undulated transverse bands, reaching as far as the lateral line, which is itself bounded beneath by a continued stripe of brown; abdomen silvery. The fins pale, the pectorals crossed with a few brown bars.[2]

S. variegatus, Lacépède, Quoy, and Gaimard. The jaws, tongue, and palate with formidable sharp teeth. The upper parts of a dull gray, banded transversely with eight or nine brown bands, broad and irregular when ceasing at the centre of the fish. The under parts tinted with rose colour. The eye red and brilliant. In this fish the second dorsal fin is so small as not easily to be perceived. Found in the neighbourhood of the Sandwich Isles.[3]

S. gracilis, Quoy and Gaimard. A small species, reaching only about four inches and a half in length. The colours are unobtrusive, being a dull gray blotched with irregular blackish spots, most defined on the sides and towards the tail. All the fins are covered with brownish specks, which on the pectorals are so disposed as to form three transverse bands. This fish was also found in the neighbourhood of the Sandwich Isles.[4]

Genus Scopeles, Cuvier. Mouth and opening of the gills wide; the jaws furnished with very fine teeth; the upper jaw formed entirely by the inter-maxillaries; the tongue and palate smooth; the branchial rays from nine to ten; the adipose fin small, but having a trace of bony rays. The species are small in size, and live in shoals. They are found in the Mediterranean Sea. The *Sc. Humboldtii* of Risso offers a characteristic example.

Genus Aulopus, Cuvier. In this form the characters of the *Cod* or *Gadi*, and *Salmones*, are united. The mouth is widely cleft, the inter-maxillary bones, which form the border of the upper jaw, are furnished, together with the palatine bones, the vomer, and the lower jaw, with a narrow stripe of teeth *en carde*. The maxillary bones are longer, and without teeth. The ventral fins are placed almost under the pectoral fins, and have the outer rays strong, and simply forked. The body, cheeks, and opercles, are covered with large ciliated scales. *Salmo filamentosus* of Bloch illustrates *Aulopus*.

Genus Sternoptyx, Herman. These curious fish have by Cuvier been placed under the above title at the conclusion of his Salmonidæ. They embrace two forms, which, he thinks, will eventually be converted into sub-genera. They are of small size, the body high, and very compressed; the mouth directed upwards. The humeral bones form on the fore-part a sharp crest or ridge, terminated below by a small spine. The pelvic bones form another and similar crest, also terminated by a small spine placed before the ventral fins, which are so minute as to have escaped the observation of the first observer. On each side of the last ridge there is a row of small hollows, which has been regarded as a fold of the sternum, and has suggested the name of *Sternoptyx*. Before the dorsal fin there is a bag or membranous ridge, and behind this fin there is a small membranous projection, which is thought to represent the adipose fin of the true Salmones.

The first form of this genus has very fine teeth, with five rays to the branchial membrane, and is represented by *St. Hermannii*. The second has the teeth hooked, and nine rays to the branchial membrane. *St. Olfersii* exhibits the only known example. Both species are from the warmer parts of the Atlantic Ocean.

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[1] Named from their lengthened Saurian or lizard-like form, and distinguished from the other groups derived by Cuvier from the genus *Characinus* of Artedi, by the branchial rays ranging from eight to fifteen in number.

[2] Shaw, *General Zoology*, vol. v.

[3] *Voyage de Freycinet.*

[4] *Ibid.*

Malacopterygii Abdominales. Clupidæ.

FAMILY V.—CLUPIDÆ.

Fishes allied to herrings are easily recognised by their having no adipose fins; their upper jaw is formed as in trouts,—in the middle by inter-maxillary bones without pedicles, and on the sides by the maxillary bones; their body is always very scaly. The majority of the species possess a swimming bladder and numerous cæca. Those which ascend rivers are comparatively few in number.

The great genus CLUPEA of Linnæus may be known by two well-marked characters; 1*st*, by the narrow and short inter-maxillary bones, which constitute only a small portion of the upper jaw, the sides of which are completed by the maxillaries in such a way that the lateral parts only are protractile; and, 2*d*, by the compressed and sharp inferior edge of the body, upon which the scales project like the teeth of a saw. Besides, the maxillaries are divided into three pieces. The branchial openings are very much cleft; and hence these fishes speedily die when removed from their native element.

Their branchial arches are furnished on the side next the mouth with pectiniform dentations. The stomach has the form of an elongated pouch; the swimming bladder is long and pointed, and in some species sends forwards two long and small processes, which communicate with the internal ear in a remarkable manner. Their cæca are numerous. Of all fishes, these have the most numerous and the finest bones.

GENUS CLUPEA, Cuv. Herrings, *properly so called.* The maxillary bones arched anteriorly, and longitudinally divisible into several pieces; the opening of the mouth of moderate size; the upper lip not emarginate.

C. harengus, Linn. The common herring; *le Hareng*, Fr.; *der Häring*, Ger. This well-known fish has visible teeth in both its jaws; the carina of the belly is but slightly marked; the sub-opercle is rounded; there are veins on the sub-orbital, pre-opercle, and upper part of the opercle. The attachment of the ventral fins corresponds to the middle of the dorsal; the head is one fifth of the length of the whole fish, and by carrying backwards from the first dorsal fin the distance of that organ from the snout, we arrive at the middle of the caudal. The anal fin has sixteen rays.

The investigation of the habits of this fish has not received that attention which its importance as an article of food to the inhabitants of this country demands; and there are several circumstances respecting its economy which still require farther examination. It is generally believed that the herring inhabits in winter the depths of the Arctic Ocean, or other seas in northern latitudes, and that during the rest of the year it makes migrations southwards. In summer and autumn they appear on the north and west coasts of Europe in immense shoals, and about the same season they arrive at some parts of the coast of America and Asia. It has been supposed that those coming from the north divide into two detachments, one of which proceeds along Newfoundland to America, the other along Norway to the south of Europe, and that one subdivision of this second detachment goes up the Baltic, while the other proceeds along Great Britain, Ireland, Germany, and France, as far as the western coast of Spain.

This is the description of the annual migrations of the herring given by Pennant; but some doubts have been entertained as to its accuracy, from the circumstances, 1*st*, that while in some places the herrings do not make their appearance for years, in others they are taken in abundance all the year round; and, 2*d*, that they have never been observed on their return northwards. Other naturalists suppose that they come merely from the deep into shallow water during the spawning season, and that in so doing they do not make any very lengthened journeys. In truth, we are not as yet furnished with sufficient data to decide the question; but, in the mean time, we do not feel inclined entirely to reject the generally received opinion, that the herrings migrate from north to south in summer and autumn.

Malacopterygii Abdominales. Clupidæ.

In migrating, the herrings proceed in vast troops,—so great, indeed, that the sea is sometimes covered with them for miles, and that they have even been known to be stranded or crushed in immense quantities in confined bays, or when thrown by the wind or by currents upon the shore. The shoals are said to be generally preceded, sometimes for days, by one or two males. The largest generally go first, to act in some measure as guides; and, as they proceed onwards, immense numbers fall an easy and unresisting prey to rapacious birds, or to their own not less rapacious kindred of the sea.

It is generally believed that the herrings captured far north are larger, fatter, and of a better quality, than those of the south; and for this reason, in the month of July, our fishermen go out to meet the shoals as far as Orkney and Shetland. The greatest number are taken on the coasts of Norway and Sweden, in the first of which countries it is said that about 400 millions are taken in one year, and sometimes twenty millions in a single fishery. The inhabitants in the neighbourhood of Gothenburg, in Sweden, take as many as 700 millions in a year. Herrings are fished also in great quantity in this country, Germany, France, Holland, the United States, and Kamtschatka.

The average size of the herring is stated to be about ten inches. According to Dr Knox, the females are considerably larger than the males,—the largest female he found on the east coast of Scotland measuring eleven inches, the largest male nine inches and a half. It does not appear to be precisely known at what age they attain their full size.

Considerable doubt has at all times prevailed regarding the food of the herring. They were generally stated to live on small crabs and fishes, and on a minute crustaceous animal named by Fabricius *Astacus harengum.* But this was chiefly matter of supposition, for most practical fishermen described the stomach of the fish when in good state as quite empty, or, at most, as containing a little brownish mucus; and it has appeared difficult to reconcile the fact, that it is when the stomach appears thus empty that the fish is in its best condition, viz. fullest, with the finest flavour, and most capable of keeping,—with the notion, that when it appears upon our coasts it has quitted its natural feeding ground, and has been longer and longer in a state of starvation the more southern the latitude in which it is found. Dr Knox's interesting observation, that the principal food of the salmon and vendace consisted of minute crustaceous animals, led him to examine carefully with the microscope the brownish matter contained in the alleged empty stomachs of the herring; and he then formed the opinion, that this matter consisted of the debris of a very minute entomostracous animal.[1]

It is well known that the herrings caught upon the east coast of Scotland are much inferior to those taken on the west coast, and more particularly to those of Loch Fine, and other lochs of Argyleshire. Dr Knox states that the herrings taken near the Firth of Forth in July are foul, or are engaged in spawning, while those of the west coast, in the same season, have the organs of reproduction very slightly developed; and he conjectures that that species of crustaceous animal which forms their appropriate and most favourite food may exist abundantly in the bays on the west coast of Scotland, and either not at all, or not in

[1] It is figured in the *Edin. Phil. Trans.* vol. xii. pl. x.

sufficient quantities, along our eastern coasts. It appears to be chiefly after these fishes have been absent for some time from their proper feeding places that they eat marine worms and small fishes; and when so feeding they lose much of their flavour, and run rapidly into putrefaction after being captured. The time of spawning seems to vary considerably, both in the same and in different districts; so that we may have spring, summer, and autumn herrings, as we know they have in some parts of the Baltic. During the spawning season they are seen to rub their bellies against the rocks or sand. As many as 68,606 eggs have been counted in one female. The young do not accompany the larger herrings in their migrations.

Of the genus *Clupea*, Cuvier makes four other species besides the common herring, viz. the *sprat*, *white-bait*, *pilchard*, and *sardine*. Of these we shall now give a short account.

Clupea sprattus, Bl. The sprat, mellet (*Esprot*, *Haranguet*, Fr.), bears a very close resemblance in form to the herring, but does not attain the same size. The number of its vertebræ is forty-eight, and the dorsal fin is placed farther back than in the herring. It has no veins on the opercle; a gilded band runs along the sides in the spawning season. This fish is eaten in considerable quantity in this country, both in the fresh and salted condition. It appears in the Thames from November to March.

Clupea latulus, Cuv. White-bait (*Blanquette*, Fr.; *die Breitling*, Germ.) has the body more compressed, and the belly sharper, than the herring. The length of its head, and height of its body, are each one fourth of the whole length of the fish. The dorsal fin is placed farther forwards, the anal is longer and situate nearer the caudal fin, than in the herring.

Considerable difference of opinion formerly existed among ichthyological writers as to the exact specific nature of the white-bait. Pennant and Shaw considered it as allied to the bleak, *Cyprinus alburnus*. Turton, Donovan, and Fleming, regard it as the young of the shad *Clupea alosa*, an opinion which was generally received as correct, until Mr Yarrell in 1828 ascertained that the number of vertebræ in the white-bait is invariably fifty-six, and in the shad only fifty-five; and he is thus supposed to have demonstrated that the well-known *white-bait* ought to be regarded as a species distinct from every other. It is a very small fish, seldom exceeding four inches in length. It is of a very brilliant silvery colour, and has a black spot on the end of the snout. The flavour of the white-bait is considered as particularly delicate, and great numbers are eaten by the Londoners in the month of July, at which time innumerable quantities make their appearance in the Thames.

Clupea pilchardus, Bl. The pilchard (*le Célan*, Fr.) nearly equals the herring in size, and bears a considerable resemblance to it in form. The sub-opercle is quadrangular, the pre-opercle and opercle striated; the head proportionally shorter than in the herring, and the dorsal fin placed farther forwards. The ventral fins begin as it were under the end of the dorsal; the anal consists of eighteen rays; and on each side of the caudal two scales longer than the rest project. The habits of this fish seem to be nearly the same as those of the herring. It is believed, like it, to reside in winter and spring in the northern seas, and to proceed southwards in the beginning of summer. It is fished in enormous quantities off the coast of Cornwall for the purpose of salting and exporting to the Mediterranean, especially to Naples. It appears there in July. Its flavour is considered by some as even superior to that of the herring.

Clupea sardina, Cuv. The sardine, which is esteemed for the extreme delicacy of its flavour, differs only in size from the pilchard. Numbers are taken off the coast of Brittany, and also in the Mediterranean.

GENUS ALOSA, Cuv. This genus is distinguished from the herrings properly so called, by an emargination in the upper jaw; its other characters seem in all respects the same as those of the pilchard and sardine.

Alosa vulgaris, Cuv.; *Clupea alosa*, Linn. Plate CCCV. fig. 2. The shad is distinguished by the absence of sensible teeth, and by an irregular black spot behind the gills. This fish is much larger than the herring, attaining sometimes to the length of three feet. It is also of a much flatter shape; its tail is much forked; and on each side of the lower margin of the belly the scales are very large. It is a native of the Mediterranean, as well as of the North Atlantic and Caspian Seas. According to Pennant, the best in this country are found in the Severn. The shad ascends rivers in spring and the beginning of summer, and it is then highly esteemed; but it is of a dry and disagreeable flavour when taken at sea. The Russians believe that the shad has deleterious properties. The Arabs smoke-dry it. This species lives chiefly on vermes, insects, and small fishes; and Dr Fleming informs us that he has taken small herrings from its stomach. The number ascending rivers varies very much in different years.

Alosa finta; *Clupea finta*, Lacép. The *veuth* of the Flemish is more elongated than the shad, and has well-marked teeth in both jaws; there are five or six black spots along the flanks. It is found as far south as the Nile. Its taste is very inferior.

GENUS CHATOESSUS, Cuv. The chatoessi are true herrings, with the last dorsal ray prolonged into a filament. Some have the jaws equal and the snout not prominent, and a small mouth devoid of teeth. In others the snout is more prominent than the jaws; an equally small mouth with the preceding; the upper combs of the first pair of gills unite together so as to form a very singular pennated point beneath the palate.

At the end of the true herrings Cuvier has placed some foreign genera which resemble them in their sharp and dentated belly.

GENUS ODONTOGNATHUS, Lacép.; *Gnathobolus*, Schn. Has the body much compressed, and very sharp dentations along the whole of the belly; the anal fin long, and projecting little; the dorsal so brittle as to be almost always destroyed; six rays in the branchial covers. The maxillary bone is somewhat prolonged into a point, and is armed with small teeth directed forwards. There are no ventral fins.

One species only is known. It comes from Cayenne; resembles a small sardine, and is called by Lacépède the *Odontognathe Aiguillonné*.

GENUS PRISTIGASTER, Cuv. Has the head and teeth similar to those of the herrings; four rays to the gill-covers, and no ventral fins; the belly much compressed, its lower edge arched, and sharply dentated.

The *Prist. tardoore* and *Prist. cayanus* are mentioned by Cuvier as known species existing in both oceans.

GENUS NOTOPTERUS, Lacép. Was placed among the *Gymnoti* for some time, on account of a resemblance occasioned by the extreme length of the anal fin. The species have scaly cheeks and opercles; the sub-orbitals, lower part of the pre-opercles, the inter-opercles, the two crests of the lower jaw, and the keel of the belly, dentated; there are fine teeth in both palates and jaws, and strongly hooked teeth on the tongue. The branchiostegous membrane has only one strong osseous ray. There are two very small ventral fins, followed by an anal, which occupies three fourths of the whole length of the fish, and united as in the gymnoti to the caudal fin. A small dorsal fin with soft rays is placed opposite to the middle of the caudal.

One species only is known, inhabiting the fresh-water ponds of the East Indies.

Malacopterygii Abdominales. Clupidæ.

Genus Engraulis, Cuv. The *Anchovies* differ considerably from the true herrings in having the mouth cleft far behind the eyes; the gills more open, with twelve or a still greater number of rays; the maxillaries straight and elongated, and there projects in front of the mouth a small pointed muzzle, under which are fixed very small intermaxillaries.

The best known have not the sharp-edged belly; their anal fin is short, and the dorsal is placed opposite to the ventrals.

Clupea encrasicolus, Linn. The common anchovy (*l'Anchois*, Fr.) has the back of a bluish-brown colour, the belly silvery. It measures from four to seven inches long. The anchovy formed one ingredient of the *garum*, a favourite sauce of the Romans; and when pickled it is much prized at the present day. It is fished in greatest quantity in the Mediterranean, but is found as far north as the coast of Holland. It lays its spawn near the shore, from December to March, at which time it is supposed to leave the deep sea and approach the coasts. *Engraulis meletta*, Cuv., an inhabitant of the Mediterranean, is smaller than the common anchovy. Among some remarkable American species of this genus, the *Eng. edentulus* is without teeth. Others, as the *Clup. atherinoides*, *Clup. telara*, and *Clup. phasa*, have the body compressed, and its lower edge serrated.

Genus Thryssa, Cuv. Differs from the last-mentioned anchovies only in the great prolongation of the maxillaries. The species occur in the East Indies.

Genus Megalops, Lacép. Differs from the herrings in having the belly blunt, and the body not compressed. The jaws and palatine bones are covered with small, even, sharp teeth; there are from twenty-two to twenty-four rays in the gill-covers; and the last ray of the dorsal fin, as also often that of the anal, is prolonged into a filament, as in *Chatoessus*.

One species is found in America, the Savalle or Apalike (*Clup. cyprinoides*, Bl.), which attains the enormous length of twelve feet; it has fifteen dorsal rays. Another Indian species, *Megalope filamenteux* of Lacép., has been confounded by Russel with the preceding, under the name of *Apalike*. Its dorsal fin has seventeen rays.

Genus Elops, Linn. Is very similar in structure to *Megalops*, but wants the elongated filament of the dorsal fin. It has thirty or more rays in the branchiostegous membrane; a flat spine on the upper and lower edge of the caudal fin. The species are found in both hemispheres.

Elops saurus is described by Sir Hans Sloane as belonging to America. According to Cuvier, the *Argentina machnata*, Forsk., *Mugil salmoneus*, Forsk., the *Tinagow*, Russ., *Synode chinois*, Lac., *Mugil appendiculatus*, Bosc, the *Pounder*, Sloane, and the *Argentina Carolina*, Linn., are all the same as *Elops saurus*, while the *Saurus maximus*, usually confounded with it, belongs to a different genus.

Genus Butirinus, Commerson. Muzzle prominent like that of the anchovies, and the mouth slightly cleft; twelve or thirteen rays on the branchiostegous membrane; close and even teeth on the jaws; and (a peculiar character) the tongue, vomer, and palatines closely paved with rounded teeth. These fishes are described under various names by different authors.

The *Elopes* and *Butirini* are found in both oceans. They are pretty, silvery-looking fishes, and make excellent soup.

Genus Chirocentrus, Cuv. Have the jaws formed like those of the herrings; both maxillaries and inter-maxillaries furnished with strong conical teeth, two of which above and all below are very long. The tongue and branchial arches are bristled with teeth like a comb, but there are none on the vomer or palatines. Their gill-covers have seven or eight rays, of which the external are very broad. Above and below each pectoral fin is a long, pointed, membranous scale, and the rays of those fins are very hard. The body is elongated, compressed, and sharp beneath, but not serrated. The ventral fins are very small, and the dorsal shorter than the anal, opposite to which it is placed. The stomach forms a long, narrow, and pointed sac, the pylorus being near the cardia; no cæca; the swimming bladder long and narrow.

One species only is known, of a silvery hue, and from the Indian Ocean. It is the *Esoce chirocentre*, Lac., *Clup. dentex*, Schn. and Forsk., *Clup. dorab*, Gmel., *Wallach*, Russ., and probably also the *Parring* or *Chnees* of the Moluccas.

Genus Hyodon, Lesueur. Possesses the general form of the herrings, and their sharp belly, but that part is not serrated. The dorsal fin is placed opposite to the anal; the gill-covers have eight or nine rays; hooked teeth on the vomer; palatines and tongue as in trouts.

Those which are known live in the fresh waters of North America.

Genus Erythrinus, Gronov. A range of conical teeth in each jaw, some of which in front are longer than the rest; the palatines are covered with close even teeth. The gill-covers have five broad rays; the head is without scales; and the cheeks covered by hard sub-orbitals. The body long, little compressed, covered with large scales like those of the carp. The dorsal fin is placed above the ventrals. The stomach forms a broad sac, and there are numerous small cæca. The swimming bladder is very large.

We may mention as a characteristic species the *Esox Malabaricus* of Bloch.

These fishes inhabit the fresh waters of warm climates. Their flesh is agreeable.

Genus Amia, Linn. Similar to the preceding in many respects, but with twelve rays in the gill-covers. Below the lower jaw is an osseous buckler, which exists also in *Megalops* and *Elops*, though of smaller size in those genera. The dorsal fin, beginning between the pectorals and ventrals, extends nearly to the caudal; the anal is short. Each nostril has a small tubular appendage. The stomach is ample and fleshy; the intestine without cæca. The swimming bladder is cellular, like the lung of a reptile.

Only one species, *Amia calva*, is known. It resides in the rivers of Carolina, where it feeds on crabs. It is seldom eaten.

Genus Sudis, Cuv. The characters of this group are nearly the same as those of *Erythrinus*, excepting that their body is proportionally longer, and the dorsal and anal fins are placed opposite to each other, and, nearly of an equal size, occupy the posterior third of the length of the body. The species live in fresh water.

Three kinds are now known. One, *Sudis Adansonii*, Cuv., was found in Senegal by Adanson, and in the Nile by Rüppel. Another, of a much larger size, with great bony scales and an oblong muzzle, is a native of Brazil,—the *Sudis gigas*, Cuv. A third, *Sudis Niloticus*, discovered by Ehrenberg in the Nile, has a singular spirally convoluted funnel adhering to the third gill, which may be analogous to what has been observed in *Anabas* and neighbouring genera.

Genus Osteoglossum, Vandelli. Distinguished from *Sudis* principally by two barbels, which depend from the symphysis of the lower jaw; the anal and caudal fins are united. The tongue is rendered very rough by a covering of short straight teeth, so that it may be used as a rasp to reduce fruits to a pulp.

Osteoglossum Vandellii, Cuv., is a native of Brazil.

Genus Lepisosteus, Lacép. Muzzle formed by the union of the maxillaries, inter-maxillaries, and palatines, with the vomer and ethmoid, which the lower jaw equals in length. The jaws have along their edge a row of long and pointed teeth, and their inner surface is rendered bristly by a covering of sharp, rasp-like teeth. The gill-covers are united below by a common membrane, having three rays on each side. These fishes are covered with scales of a stony hardness. The dorsal and anal fins, which are opposite to one another, are both situate very far back. The two outer rays of the tail, and the first ray of all the other fins, are furnished with scales so as to make them appear dentated. The pylorus has many short cæca. The swimming bladder is cellular, as in *Amia*.

There appear to be several species or varieties of this fish. They inhabit the rivers and lakes of the warm parts of America. They grow to a considerable size, and are considered to be good eating. Dr Fleming observes, that the claims of *Lepisosteus osseus* to rank as a British species are very doubtful. Berkenhout indeed has inserted it in his *Synopsis* (p. 81), with the habitat of *Sussex coast;* and Mr Stewart, in his *Elements of Nat. Hist.* (vol. i. p. 374), intimates its occurrence in the Firth of Forth; but we are not aware of its having been seen among us in recent times. We here figure the *Lepisosteus spatula* of Lacépède (*Esox Cepedianus*, Shaw), a native of the seas and rivers of America. Plate CCCV. fig. 4.

Genus Polypterus, Geoff. Distinguished at once from other genera by a number of separate fins placed along the back, each supported by a strong spine, to the posterior edge of which are attached some soft rays. The caudal fin surrounds the end of the tail, and the anal is very near it; the ventrals are very far back. The body is covered with bony scales like those of the preceding genus, and the whole cheek is covered by an osseous plate, shagreened in a similar manner to those on the rest of the head. Around each jaw there is a row of conical teeth, and behind some close or rasp-like teeth. Their stomach is capacious, the intestine narrow, with a spiral valve and one cæcum. The swimming bladder is double, with large lobes, particularly that on the left side, communicating by a wide aperture with the œsophagus.

Polypt. bichir (*P. Niloticus*, Shaw) may be named as a species of the genus. It has sixteen dorsal fins, and was discovered by M. Geoffroy in the Nile. (See Plate CCCV. fig. 3.) *Polypt. Senegalus*, Cuv. is another species from Senegal. It has only twelve dorsal fins. The flesh of these fish is good eating.

ORDER III.—MALACOPTERYGII SUB-BRACHIATI.

This order is characterised by the attachment of the ventral fins beneath the pectorals,—which latter may be regarded as analogous to the arms, and hence the name *Sub-brachian*. The pelvis is suspended immediately from the bones of the shoulder.

This order contains as many families as Linnæan genera.

FAMILY I.—GADIDÆ.

Comprehends the members of the great Linnæan genus Gadus, containing the well-known cod and haddock.

The Gadi in general are recognised by the ventral fins being pointed and attached to the throat. The body is moderately elongated, slightly compressed, and covered with soft and not very large scales. The head is well proportioned, and without scales; all the fins are soft. The jaws, and the front of the vomer, are armed with several rows of pointed, irregular, middle-sized, or small teeth, forming a sort of currycomb or rasp. Their gill-covers are large, with seven rays. Most of the species have two or three fins on the back, one or two behind the anus, and a distinct caudal. Their stomach forms a large muscular sac; the cæca are very numerous. The swimming bladder is large, and has strong parietes, frequently dentated on the sides.

These fishes generally live in cold or temperate climates, and constitute a very important article of fishery. The greater number are considered wholesome, and form a light and agreeable food,—the flesh separating easily by boiling, into white flaky layers. The great sand bank of Newfoundland is the most famous station of the cod fisheries, and is resorted to by English fishermen, who chiefly use the hook and line. The fish abound in this place probably on account of the great quantity of the smaller animals which serve as food, viz. mussels, clams, &c.

The family of Gadidæ has been divided by Cuvier into Morrhua, or cods properly so called, Merlangus or whitings, Merluccius or hakes, Lota or lings, Motella, Brosmius, Brotula, Phycis, and Raniceps.

Genus Morrhua, Cuv. Has three dorsal fins and two anal; a tuft at the point of the lower jaw. The species are extremely prolific.

M. vulgaris (*Gadus morrhua*, L.). The common cod (*la Morue*, Fr.; *Kabliau*, Germ.) measures from two to three feet in length. The back is spotted with yellowish brown. It inhabits the whole Northern Ocean, and occurs in vast profusion.

This fish dwells in salt water only. It is not found nearer the equator than the 40th degree of latitude. The weight of the common cod varies from twelve to eighty or even 100 pounds. It is extremely voracious, and its digestive powers are seemingly very great. It feeds upon smaller fishes, such as herrings, on Mollusca, worms, and Crustacea, and even on the young of its own species. It has a strong muscular stomach, and is said to possess the power of rejecting by the mouth substances, such as wood, &c. which it finds indigestible.

In spring they come nearer the shore in order to deposit their spawn. This happens in January in England, in February in Norway, Denmark, and Scotland, and in March in Newfoundland. One female is said to contain from *four* to *nine millions* of eggs!

The most extensive cod fisheries on our coasts are off the Western and Shetland Isles, but they are still greater in more northern countries. The cod has been fished on the coast of Sweden since the year 1368, by the inhabitants of Amsterdam. The English resorted to Iceland before the year 1415; and it is stated that in the year 1792, 200 French vessels of a burden of 191,153 tons were employed in the cod fishery. Every year more than 6000 European vessels are employed in this fishery.[1]

The flesh of the cod has a good flavour, and may be easily preserved. The tongue, salted and dried, has been considered a great delicacy. The gills are preserved and used as bait. The liver is eaten, and is sometimes used for the production of oil. The swimming bladder affords a very good isinglass.

This important species constitutes a principal article of food to the inhabitants in some parts of Iceland, Norway, and other northern countries. In a dried state it is also much used in some papal kingdoms of the south.

In the neighbourhood of the Isle of Man, and elsewhere, there is a variety of the cod named the red or rock cod, the skin of which is of a brightish vermillion colour. Its flesh is much esteemed.

[1] We cannot in this place enter upon the important subject of *Fisheries;* but the reader may consult with advantage Pennant's *British Zoology*, vol. iii. and Duhamel's *Traité Général des Pesches.*

M. æglefinus (*Gadus æglefinus*, Linn.). The haddock (*l'Egrefin*, Fr.; *Schollfisch*, Germ.) is as well known, and almost as important, as the cod in this country; it is of a smaller size, usually eighteen inches long. The back is brown, the belly silvery, and the lateral line black. There is a blackish spot behind the pectoral fin, which tradition assigns to the impression of St Peter's finger and thumb when he took the tribute-money out of the mouth of a fish, supposed the haddock. The upper jaw is longest.

The haddock is found, like the cod, in the Northern Ocean, but has not been seen in the Baltic. It annually approaches the shores, in February and March generally, in order to deposit its spawn. The regularity with which it re-appears in some districts on a stated day is quite remarkable. On the coast of Yorkshire, since the year 1766, they have annually made their appearance on the 10th of December. At this place they are supposed to form an immense shoal three miles broad, and extending eighty miles in length,—from Flamborough Head to the mouth of the Tyne. It is in autumn that they visit the shores of Holland and East Friesland, and the neighbourhood of Heligoland.

The haddock frequents our coasts during the greater part of the year, although the largest are taken in winter. The flesh is generally best in the months of May and June.

It is stated, that in the north, when the sea is frozen near the shore, these fish collect in troops beneath any openings in the ice, and the Greenlanders are thus enabled to catch them in considerable numbers. The seals and foxes adopt the same method of securing them for food. The food of the haddock is very similar to that of the cod, which species it resembles in its voracious habits.

M. callarias (*Gadus callarias*, Linn.). The dorse (*Faux Merlan*, Fr.) is smaller than the haddock, being only eleven or twelve inches long. It is spotted like the cod, and has the upper jaw longer than the under. The lateral line is placed near the back. It resembles the whiting in taste, and is considered by many as the best eating fish of all the Gadus tribe. It is much sought after on the shores of the Baltic.

This fish frequents the mouths of large rivers, which it sometimes ascends along with the salt water. It is generally taken in June. The Icelanders salt and dry it, and the Greenlanders are said frequently to eat it in a state of semi-putrefaction.

To these fishes, which are among the best-determined species of the old genus Gadus, may be added *Gadus barbatus* or whiting pout, a fish about eighteen inches or two feet long, which is eaten by the Greenlanders, but not much esteemed. *Gadus minutus*, the capelan or poor, *Gadus punctatus*, the speckled cod, and *Gadus luscus*, the bib, may be named as other species which occur along the British shores.

Genus Merlangus, Cuv. The whitings have the same number of fins as the cods, but they want the barbels.

M. vulgaris (*Gadus merlangus*, Linn.). The whiting, *Merlan*, Fr.; *Witling*, Germ. The body a foot or more in length; upper jaw long; pale reddish-gray back, and silvery belly; lateral line yellow, nearly straight.

This fish is very common on our coasts, and is valued on account of its abundance, and the wholesomeness and fine flavour of its flesh. It is often salted and dried in this country, as well as in Holland. The shoals of whitings sometimes occupy a space three miles long, and one and a half broad. It is generally fished in summer in this country, and is taken both with the line and net. The food of the whiting is similar to that of the haddock. It is more frequently found near the shore than that species.

M. carbonarius (*Gadus carbonarius*, L.). The coal-fish (*Merlan noir ou Colin*, Fr.; *Kohlfisch*, Germ.) is twice the size of the whiting, and of a deep brown colour; the upper jaw shortest; the lateral line straight and white. The flesh of the young is rather delicate; that of the adult is somewhat leathery, but it is used when salted and dried, like the cod. This is the *podley*, *silloch*, *cuddy*, &c. of our coasts. The young swarm along the British shores, and form a frequent sustenance of the lower orders of the Western Highlands. On one occasion we killed thirty-three dozen with the rod in a few hours, using a line with six small flies. By giving the line one or two additional turns through the water, we frequently pulled six ashore at once. It even constitutes an important article of exportation from our northern coasts. In Norway the poor feed upon it; and oil is made from its liver. The adult fish is taken principally in summer; it deposits its spawn in this country in February and March. The coal-fish is found in the North Atlantic and Pacific Oceans; and sometimes, though very rarely, in the Mediterranean Sea,—for example, near Nice.

M. pollachius (*Gadus pollachius*, L.). The pollock or pollack, *Merlan jaune*, Fr. About eighteen inches long; resembles *M. carbonarius* in its general form and structure of the jaws; brown above and silvery beneath; sides spotted; lateral line curved, black. The flesh of the pollock is considered better than that of the coal-fish, and inferior only to that of the dorse and whiting; it inhabits the Atlantic, and is gregarious. It is commonest on the coasts of Norway and the north of England, and sometimes occurs in the Mediterranean in winter. It is easily caught with a white fly.

Gadus virens, Ascan., the sey, may also be included in the genus Merlangus.

Genus Merluccius, Cuv. The hakes have only two dorsal fins and one anal, and resemble the whitings in the absence of the barbels.

M. vulgaris (*Gadus merluccius*, L.). The hake (*le Merlus*, Fr.) is generally from one to two feet long, but sometimes much larger. The back of a brownish-gray colour; the anterior dorsal fin pointed; the lower jaw longest.

Great numbers are taken in the ocean, and in the Mediterranean. On the coasts of the Mediterranean it is called merlan or whiting; and, when dried, it receives in the north the name of stock-fish, in the same way as the cod. It is said to be very abundant in the Bay of Galway on the west of Ireland, and at Penzance in Cornwall. The flesh is white and flaky, and its liver is considered a delicacy.

Gadus magellanicus, Forst., and *Gadus maraldi*, Risso, may be included in this group.

Genus Lota, Cuv. The *lings* have the same fins as the hakes, but are also provided with barbels to a greater or less amount.

Lota molva (*Gadus molva*, L.) or common ling (*la Lingue*, or *Morue longue*, Fr.), is the best-known species. It measures from three to four feet in length, and sometimes even attains the size of seven feet; it is named ling from its lengthened shape. Olive above, silvery beneath. The fins have a white margin; the two dorsal fins are of equal height. The lower jaw rather the shortest, and furnished with a single barbel.

This fish spawns in June; it inhabits the same seas as the cod, and is fished in the same manner during the spring months. It is preserved dry, and exported in considerable quantity.

Lota fluviatilis (*Gadus lota*, L.), river ling or burbot (*la Lotte commune*, Fr.), is from one to two feet long. Its colour yellow, marbled with brown; a single barbel on the chin. The two dorsal fins are of equal height, the second extending to near the tail. The body is almost cylindrical, and the head slightly depressed, so as to give the fish a peculiar appearance, somewhat resembling that of an eel; hence its occasional name of Eel Pout. See Plate CCCV. fig. 5.

This is the only Gadus which inhabits fresh water; it ascends rivers to a considerable distance, and inhabits lakes. It is very abundant in North Asia and the Indies. It is also well known in North America. In England it is found only in a few rivers. The flesh and liver of the burbot are esteemed.[1]

To this sub-genus may be added *Gadus Bacchus*, Forst., *Gadus maculosus*, Lesueur, and *Lota elongata*, Risso.

Among the lings, Cuvier has distinguished another small group named

GENUS MOTELLA, Cuv., in which the anterior dorsal fin is so small as scarcely to be perceptible.

As species we may name *Gadus mustela*, L. described by Bloch as *G. tricirrhatus.* It is of a fawn-coloured brown, with blackish spots; two barbels on the upper jaw, and a third on the lower one. *Gadus cimbricus*, Schn. (*G. quinquecirrhatus*, Penn.) is also a *Motella.* The species are called *Gades* by English writers.

GENUS BROSMIUS, Cuv. The *torsks* or *tusks* have only one dorsal fin, which extends nearly the whole length from the head to the tail.

B. brosme, or Scotch torsk, seldom ventures farther south than the Orkneys or Caithness; it is very numerous near the Shetland Isles. It is called *Brosme* by the fishermen, from its resemblance to the blenny genus. The name of torsk is applied in Norway and Sweden to the *Gadus callarias* (a true *Morrhua*), which has three dorsal fins. This circumstance has given rise to some confusion. Donovan described the Scotch torsk from a specimen sent him alive from Shetland. It is salted and dried in the north.

GENUS BROTULA, Cuv. Dorsal and anal fins united with the caudal, so as to form a single fin, terminating in a point.

One species only (*Enchelyopus barbatus* of Bloch and Schneider) is known. It has six barbels, and comes from the Antilles.

GENUS PHYCIS, Art. and Schn. Differs from the other Gadi in having ventral fins with only one ray,—frequently forked. The head is thick, the chin with one barbel. Two dorsal fins, the second of which is long. Some species are found in European seas.

Such is *Phycis Mediterraneus*, Laroche, sometimes called the sea tench (*Blennius phycis*, Linn.). Anterior dorsal round, and not higher than the other; the ventrals of the same length as the head. This is a common species in the Mediterranean.

Phycis blennoides, Schn., *S. furcatus*, or forked hake of Pennant, occurs also in the ocean. The first dorsal fin is more elevated, and its first ray considerably elongated; the ventral fins are twice the length of the head. It is a British species, though a rare one.

GENUS RANICEPS, Cuv. The head more depressed than in Phycis and the other Gadi; the anterior dorsal fin so small that it is lost in the thickness of the skin. Inhabits the ocean.

The trifurcated hake of Pennant belongs to this genus.

GENUS MACROURUS, Bl. *Lepidoleprus*, Risso. The suborbitals unite in front with each other and with the bones of the nose, so as to form a depressed snout, which projects above the mouth, and beneath which the latter preserves its mobility. The head and body are covered with hard and spiny scales. The ventral fins are small and somewhat jugular; the pectorals of moderate size; the first dorsal short and high; the second dorsal and anal both very long, and uniting with the caudal; very fine short teeth in the jaws.

The species inhabit deep water, and when taken from it utter sounds resembling those of the genus *Gristes.* Only two species have been as yet described, the *Lep. cælorhynchus* and *trachyrynchus* of Risso. They occur both in the Mediterranean and along the oceanic coasts of France.

FAMILY II.—PLEURONECTIDÆ.

This family of the sub-brachian malacopterygian order comprehends the great Linnean genus PLEURONECTES, which includes all those osseous species usually known under the name of *flat fish.*

They are at once distinguished by a character unique among vertebrated animals, viz. the want of symmetry in the construction of the head; both eyes being placed on the same side, or on that which remains uppermost when the animal swims, and which is always of a darker colour; while the side in which the eyes are wanting faces the ground, and is always whitish, or very pale. Some of the other organs participate in this irregularity of the orbits; thus the two sides of the mouth are unequal, and the two pectoral fins are generally of different sizes. Their body is much compressed, and raised vertically. The dorsal fin runs along the whole of the back, the anal occupies what may be regarded as the under part of the body, and the ventrals have almost the appearance of continuing that fin forwards, so much do they often appear as if united together. There are six rays in the branchiostegous membrane. The abdominal cavity is small (the anus being far forwards); but it is prolonged into a sinus in the thickness of the two sides of the tail, in which some portion of the viscera is lodged. There is no swimming bladder, and these fishes seldom quit the bottom.

The PLEURONECTIDÆ furnish an agreeable and wholesome food, and occur along the coasts of almost all countries. The disposition of the bones of the head is curious, on account of the inversion which brings the two orbits to the same side; still we recognise in it all the pieces common to the other genera, but of unequal size. Individuals termed *reversed* are sometimes found, having the eyes placed on a different side from that on which they are situated in the rest of their species. Others, having the two sides of the body of the same colour, are called *double.* The brown or upper side is more frequently thus repeated than the white one; but the *rose-coloured flounder* of Shaw presents an instance of the duplication of the paler side.[2]

The genus *Pleuronectes* was formerly subdivided according as the eyes were placed on the right or left side of the middle line; but, on account of the irregularity of individuals in this respect, Cuvier has rejected the character, and has distinguished various groups, as follows:

GENUS PLATESSA, Cuv. Has on each jaw a range of obtuse cutting teeth, and generally some teeth in the form of pavement (*en pavés*) on the pharyngeal bones. The dorsal fin advances forwards as far as the upper eye, and leaves, as well as the anal, a naked interval between it and the caudal. The form of the body is rhomboidal; the majority have the eyes on the right side. They have two or three small cæca. Several inhabit the British seas.

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[1] "*On estime fort sa chair*, et surtout son foie, qui est singulièrement volumineux," observes Baron Cuvier, *Règne Animal*, t. ii. p. 334. A different opinion, however, has been formed of it in the western world. "The burbot," says Dr Richardson, "is so little esteemed as food, as to be eaten only in cases of necessity. Very good bread, however, may be made of the roe, and the livers are always prized. *Dogs will scarcely ever eat this fish.*" (*Appendix* to Captain Franklin's first *Journey to the Polar Sea*, p. 724.) Dr R. adds, that this species preys upon every kind of fish that it can swallow, and that in spring its stomach is generally so crammed with cray-fish as to distort the shape of the body.

[2] *Gen. Zool.* vol. iv. part 2, pl. xliii.

P. vulgaris (*Pleuronectes platessa*, L.). The plaice (*Carelet*, Fr.; *Scholle*, Germ.) is recognised by six or seven tubercles forming a line on the right side of the head between the eyes, and by spots of a bright yellow colour, which relieve the brown of the body on that same side. This fish is three times as long as it is high. Plate CCCV. fig. 6.

The plaice grows sometimes to the size of fifteen or sixteen pounds weight, but those weighing seven or eight pounds are considered large; its flesh is more tender than that of any other species of the genus. It inhabits the Mediterranean, Baltic, and North Seas, and spawns in spring.

A large plaice, *Pl. borealis*, Fabr., having the spine behind the anus concealed under the skin, is described as belonging to the northern regions.[1]

Pl. latus, Cuv. The broad plaice (*la Plie large*, Fr.) is a much rarer species. It has the same tubercles as the common plaice, and differs from it chiefly in being only once and a half as long as it is high.

Pl. flesus, L. The flounder (*le Flet ou Picaud*, Fr.; *der Flünder*, Germ.) has nearly the same form as the plaice, with paler spots; it has only small granular eminences at the salient line of the head, and at the base of each ray of the dorsal and anal fins there is a small rough projection; the lateral line has also bristly scales. Many of this species occur reversed.

The flounder is taken in spring near the shore, and at the mouths of rivers, into which it sometimes ascends a considerable way; it lives well in fresh water, and is kept in ponds in Friesland. It inhabits the Baltic and North Atlantic Seas. Its flesh is much inferior to that of the plaice; the best are said to be taken near Memel.

Pl. pola, Cuv., is a fish described by Duhamel under the name of *La Vraie Limandelle.* It is of an oblong form, approaching to that of the sole, although broader. It is distinguished from other *Platessæ* with sharp teeth, by a smaller head and mouth. The body is smooth and the lateral line straight. In France it is considered as equal to the sole.

Pl. limanda, L. The dab or bret (*la Limande*, Fr.; *die Glahrke*, Germ.) is of a rhomboidal form, like the flounder; has large eyes, and a salient line between them. Its lateral line is strongly curved above the pectoral fin. Its scales are rougher than in the preceding species, and to this character it owes its name (from *lima*, file). Its teeth, though in a single row, as in other *Platessæ*, are narrower, and almost linear. The side on which the eyes are placed is of a clear brown, with some indistinct brown and whitish spots. This is a small fish, its length being less than a foot; but it is much esteemed. It is less common than either the plaice or flounder. It spawns in May, and is in season for the table during spring.

Genus Hippoglossus, Cuv. Has a form of body, and fins, similar to the plaices; the jaws and pharynx are armed with sharper and stronger teeth. Their form is generally more oblong.

H. vulgaris (*Pl. hippoglossus*, L.). The great holibut, or halibut (*le grand Flétan ou Helbut*, Fr.; *die Heiligbutte*, Germ.), is one of the largest of this genus inhabiting the northern seas. It sometimes attains a very great size, for example, to the length of six or seven feet, and weighing three or four hundred pounds. The skin is smooth; it has the eyes to the right side; the lateral line arched above the pectoral fin; there is a long spine before the anal fin.

This is the most voracious of all the Pleuronectidæ, preying on smaller fishes, Crustacea, Mollusca, &c. It inhabits the Mediterranean, as well as the northern seas. The flesh of the young is esteemed, and is not seldom sold to the uninitiated for turbot, to which, however, it is much inferior in every way. Indeed, when old, it is extremely coarse.[2]

In the Mediterranean there are several smaller species, of which some have the eyes to the left side. Such is *Pl. macrolepidotus*, Bl.—*Citharus*, Rond.; distinguished by the large size of its scales, its oblong form, and straight lateral line. (Plate CCCV. fig. 7.) *Pl. cynoglossus* is described by Shaw as a smaller holibut, found in considerable quantity in Greenland, and superior to the common kind as an article of food.

Genus Rhombus, Cuv. The turbots, like the holibuts, have teeth closely set, or *en carde*, both on the jaws and pharynx; but their dorsal fin advances as far as the edge of the upper jaw, and extends, in common with the anal, to near the caudal fin. The greater number have the eyes to the left.

In some the eyes are approximate, and in the interval between them there is a slight projecting crest. The two largest of our coasts are of this kind; they are the most esteemed as food of all the Pleuronectidæ.

Rh. maximus (*Pl. maximus*, L.). The turbot, *le Turbot*, Fr.; *Steinbutte*, Germ. This fish, so highly prized on account of its delicate flavour, and the wholesomeness of its flesh, is distinguished by the rhomboidal shape of its body, which is nearly as high as it is long. It is bristled on the brown side with small tubercles; has the lateral line curved; and the eyes on the left side.

This species is usually much smaller than the holibut; it is frequently two feet long, with a weight of twenty pounds; but it is stated sometimes to attain the length of five or six feet. Extensive turbot fisheries are established on different parts of our coast. The turbot is taken with the hook; it is very voracious, and may be lured by various baits, such as portions of herring or haddock, mussels, limpets, and other shell-fish; but all these must be very fresh. Indeed the species very sensibly prefers live bait without hooks, more especially the small river-lamprey. Mr Pennant has particularly described the extensive turbot fishery at Scarborough. There are three men in each of the fishing-boats, each man having three lines, and each line 280 hooks. All the nine lines are fastened together, and then extend to about three miles in length; they are laid across the current, and are allowed to remain for six hours before they are hauled. This fish is called the water or sea-pheasant, by the French common people, on account of its fine flavour.

Rh. rhombus. The pearl or brill, *la Barbue*, Fr. The body more oval than that of the turbot; without tubercles; and distinguished besides by the first rays of its dorsal fin being half free, with their extremities divided into several strips. This fish is of a smaller size than the turbot; it has a delicate flavour, and is in great request.

Rh. punctatus; Pl. lævis, Shaw. The kitt (*le Targeur*, Fr.) is much rarer than the preceding on our coasts. Its shape is oval like the brill; it has no strips on the rays of its fins; its scales are rough; its teeth very fine; its cheek furnished with very close and even teeth; and it has black points and spots on a brown ground. It is said to be more frequent in Shetland than along the other British coasts.

Rh. cardina. The whiff (*la Cardine*, or *Calimande*, Fr.) is quite of an oblong form; its first rays are free, but simple;

[1] *Isis*, xxi. p. 868.

[2] Nevertheless it is generally called *turbot* in the Edinburgh market, where the true turbot passes under the classical cognomen of *roun-fleuk*.

its teeth very close and even. It has spots partly white and partly blackish, scattered on a brown ground. This species is taken, though seldom, in the Channel.

In the Mediterranean there is a small species, only a few inches long,—*Pl. nudus*, Risso; *Arnoglossum*, Rond.; and another still smaller, which is quite transparent,—*Pl. candidissimus*, Risso; *Pl. diaphanus*, Schn.

In other turbots the eyes are distant, the upper one far back; their interval is concave; they have a small projecting hook on the base of the maxillary bone at the side on which the eyes are placed, and sometimes another on the inferior eye. There are several of this nature in the Mediterranean, such as the *Pl. podas* of Laroche.[1] We have figured *Pl. argus* on Plate CCCV. fig. 8.

Genus Solea, Cuv. The soles have, as a distinguishing character, the mouth twisted to the side opposite the eyes; that side only being furnished with teeth, which are fine, like the pile of velvet, or, according to Cuvier's frequent expression, *en velours;* the side on which the eyes are placed is toothless. Their form is oblong; the snout round, and almost always projecting more than the mouth. The dorsal fin commences at the mouth, and extends, as well as the anal, to the caudal fin. The lateral line is straight; the side of the head opposite to the eyes is furnished with a kind of villosity. The intestine is long; it forms several folds, but has no cæca.

S. vulgaris (*Pl. solea*, L.). The sole (*le Sole*, Fr.) is a species common on the European coasts, and universally esteemed wherever known. Brown on the side which bears the eyes; the pectoral fin spotted with black. It is one of our most valued fishes for the table, the flesh being firm, white, and of delicious flavour. The sole generally measures from one to two feet in length, and its weight varies from one to seven pounds. It is a gregarious fish, and is generally taken with the trawl-net. It inhabits the Baltic, North, Atlantic, and Mediterranean Seas. There is a large sole fishery at Brixham in Torbay, and a very extensive one on the coast of Sardinia. The best soles are said to be found at the Cape of Good Hope; yet our honoured friend Justice Menzies does not esteem them so highly as he did those of his native Scotland.

There are many distinct species of this genus, besides numerous varieties that have been too vaguely described to admit of their being easily distinguished from each other. We shall here merely name the *Pallasian*, *Zebra* (Plate CCCV. fig. 9), *Carolina*, *Ocellated*, *Rondeletian*, *Platessoid*, *Silver*, *Smooth*, *Bearded*, *Marbled*, *Pavonian*, and *Variegated* Soles.

Genus Monochirus, Cuv. Contains such soles as have only a very small pectoral fin on the side of the eyes, the one on the opposite side being either very minute, or wholly wanting. There is one Mediterranean species, the *Pl. microchirus* of Laroche.[2]

Genus Achirus, Lacép. Contains the species which are wholly destitute of pectoral fins; and which may again be divided according as their vertical fins are distinct, as in *Achiri* properly so called, or united to the caudal fin, as in the sub-genus *Plagusia*.

FAMILY III.—DISCOBOLI.

Forms the concluding division of the sub-brachian malacopterygian fishes. They receive their name from the disk formed by their ventral fins. This family comprehends two genera, neither of which is numerous.

Genus Lepadogaster, Gouan. The ample pectoral fins descend to the inferior surface of the body, and become united together beneath the throat by a transverse membrane, directed forwards, which is formed by the union of the two ventral fins. The body is smooth and without scales; the head broad and depressed; the muzzle projecting and extensile; the branchial openings small; the gill-covering furnished with four or five rays. There is only one soft dorsal fin, opposite to an anal of a similar kind. The intestine is short, straight, and without cæca. There is no swimming bladder, but nevertheless the species swim rapidly along the shores. The genus is divisible as follows:

1*st*, Lepadogaster properly so called. The membrane already mentioned, which takes the place of the ventral fins, extends circularly under the pelvis, and forms a concave disk; on the other hand, the bones of the shoulder form a slight projection behind, which completes a second disk with the membrane uniting the pectorals.

Several species inhabit the Mediterranean and neighbouring seas. In some the dorsal and anal fins are distinct from the caudal, with which their membrane is however sometimes continuous, though it at the same time becomes narrower. Of this kind are the *Lep. Gouani*, *balbis*, and *Decandolii*. In others, these three fins are united, as in *L. Wildenovii*. The *Cyclopterus cornubicus* of Shaw (*Jura sucker* of Pennant) belongs to the genus Lepadogaster.

2*d*, Gobiesox, Lacép. Interval between the pectoral and ventral fins not divided into a double disk, but forming only a large single disk, cleft on both sides, and prolonged by the membranes. The dorsal and anal fins are short, and distinct from the caudal. The branchial apertures are larger than in the preceding. A British species, known under the name of bimaculated sucker (*Cyc. bimaculatus*, Pennant), belongs to this genus. It is a very small fish, not measuring more than an inch and a half. Montagu found it adhering to stones and old shells, and obtained it in abundance, by dredging, near Forcross.[3]

Genus Cyclopterus, Linn. The circle-finned fishes, commonly called *suckers* or *lump-fish*, have a well-marked character in their ventral fins, the rays of which, suspended all round the pelvis, and united by a single membrane, form an oval and concave disk, which the fish employs as a sucker to fix itself to the rocks. Besides this, their mouth is wide, and furnished on both jaws and pharyngeal bones with small pointed teeth. Their opercles are small; their branchial openings closed towards the bottom, and furnished with six rays. Their pectoral fins are very large, and unite almost under the throat, embracing as it were the disk of the ventrals. Their skeleton does not harden much; and their skin, viscous and without scales, has small hard grains scattered here and there upon its surface. They have a stomach of considerable size, many cæca, a long intestine, and a swimming bladder of ordinary dimensions.

The Cyclopteri are divided by Cuvier into two sub-genera, as follows:

1*st*, Lumpus. Has a first dorsal fin, more or less perceptible, though very low, and with simple rays,—and a second one with branched rays opposite to the anal. The body is thick.

Cycl. lumpus, L. (Plate CCCV. fig. 11.) The lump-fish or sucker (*le Lump*, *Gras Mollet*, Fr.; *See Hase*, Germ.) has its first dorsal fin so much enveloped in a thick tubercular skin, that externally it might be taken for a mere hump on the back. It is furnished with three rows of conical tubercles on each side.

This fish is about eighteen inches long. It lives, especially in the north, on Medusæ and other gelatinous animals. Its flesh is soft, insipid, somewhat oily, and is sel-

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[1] *Ann. du Mus.* xiii. xxiv. 14.

[2] *Ibid.* xiii. 356.

[3] *Linn. Trans.* vol. vii. p. 293.

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dom used for food by those who can provide better. It is, however, held in some estimation by the Greenlanders, themselves an oily people, whose lines do not always fall in pleasant places. They also eat its roe (which is a very large one), after having reduced it by boiling to a pulp. In Ireland it is sometimes salted. This fish is very unwieldy, and, possessing few means of defence, it generally remains at the bottom of the sea, adhering to the rocks. It thus becomes an easy prey both to seals and sharks. Large placid oily spots upon the surface of the sea are often seen above the places where the lump-fish have been seized and slain. We also occasionally find their skins floating empty along the shore, the flesh and blood having been previously extracted by their insatiate foes. The male is said to preserve with great care the eggs which he has fecundated, and he has moreover been famed in fable for his affectionate behaviour to the female. There does not, however, appear to be any real foundation for this trait in his character,—a very unfrequent one in that of any member of the fishy tribes.

Cyclopt. spinosus inhabits the northern seas. *Cycl. minutus* is found in the Atlantic, and *C. nudus* in the Indian Ocean.

2*d*, Liparis, Artedi. Has only one dorsal fin, which, as well as the anal, is rather long. The body is smooth, elongated, and compressed behind.

Lip. vulgaris (*Cyc. liparis*, L.), the unctuous sucker of Pennant, is a European species of variable size, not uncommon about the mouths of rivers, especially those of the northern seas. It is a well-known British species, remarkable not merely for dying, but for actually *dissolving*, soon after it is taken out of the water. *Liparis Montagui* measures only about two inches in length.[1] It was discovered by the naturalist whose name it bears, among the rocks at Milton, on the south coast of Devon, during some extraordinary low tides. *Lip. gelatinosus* is another northern species, the flesh of which is not eatable, as described by Pallas in his *Spicilegia Zoologica.* Its flesh is so bad that not even dogs will eat it.

Genus Echeneis, Linn. This genus, so different from its neighbours, might, like the old Linnæan genus Pleuronectes, almost form a separate family of the sub-brachian malacopterygian fishes. The species called *Remoras* are remarkable for the flattened disk they bear upon their heads, and by means of which they can adhere to other bodies with considerable firmness. These disks are composed of a certain number of transverse cartilaginous plates, directed obliquely backwards; dentated or spinous at their posterior edge, and moveable in such a manner that the fish can create a vacancy between them; and thus, aided also by the toothed margin, it fixes itself securely either to rocks or floating bodies.

This genus has the body elongated, and clothed with small scales; a single soft dorsal fin opposite to the anal; the head quite flat above; the mouth cleft horizontally, and rounded; the lower jaw placed more forwards, and furnished, as well as the inter-maxillary bones, with small pectiniform teeth. There is a row of regularly-set small teeth, like cilia, along the edge of the maxillaries, which form the external margin of the upper jaw; the vomer is furnished with cardiform teeth, as well as the tongue. They have eight branchiostegous rays. Their stomach is a wide cul-de-sac; the cæca six or eight in number; the intestine wide, but short. They have no swimming bladder.

The species are few in number. Of these, *Echeneis remora*, Linn., the famous *Remora*, or sucking fish, of the Mediterranean, is the best known. It has usually eighteen plates in its cranial disk.

The extraordinary power possessed by this fish, of adhering tenaciously to any flattish surface, was known to ancient writers, as well as to the curious inquirers of modern times. Pliny luxuriates upon it with his usual discursive verbosity. The reader may possibly be amused by Philemon Holland's translation of the passages in question. "Having so far proceeded in the discourse of nature's historie, that I am now arrived at the very heigth of her forces, and come into a world of examples, I cannot chuse but in the first place consider the power of her operations, and the infinitnesse of her secrets, which offer themselves before our eyes in the sea: for in no part else of this universal frame is it possible to observe the like majestie of nature: insomuch, as we need not seeke any farther, nay, we ought not to make more search into her divinitie, considering there cannot be found any thing equall or like unto this one element, wherein she hath surmounted and gone beyond her own selfe in a wonderfull number of respects. For, first and foremost, is there any thing more violent than the sea; and namely when it is troubled with blustring winds, whirlepuffs, storms, and tempests? or wherein hath the wit of man been more employed (seeke out all parts of the known world) than in seconding the waves and billows of the sea, by saile and ore? Finally, is there ought more admirable than the inerrable force of the reciprocall tides of the sea, ebbing and flowing as it doth, whereby it keepeth a current also, as it were the stream of some great river?

"The current of the sea is great, the tide much, the winds vehement and forcible; and more than that, ores and sailes withall to help forward the rest, are mightie and powerfull: and yet there is one little sillie fish, named echeneis, that checketh, scorneth, and arresteth them all. Let the winds blow as much as they will, rage the storms and tempests what they can, yet this little fish commaundeth their furie, restraineth their puissance, and, maugre all their force, as great as it is, compelleth ships to stand still: a thing which no cables, be they never so big and able as they will, can perform. She bridleth the violence and tameth the greatest rage of this universall world, and that without any paine that she putteth herselfe unto, without any holding or putting backe, or any other meanes save only by cleaving and sticking fast to a vessell: in such a sort as this one small and poore fish is sufficient to resist and withstand so great a power both of sea and navie, yea and to stop the passage of a ship, doe they all what they can possible to the contrarie. What should our fleets and armadoes at sea make such turrets in their decks and forecastles? what should they fortifie their ships in warlike manner, to fight from them upon the sea, as it were from mure and rampier on firme land? See the vanitie of man! alas, how foolish are we to make all this adoe? When one little fish, not above half a foot long, is able to arrest and stay per force, yea, and hold as prisoners, our goodly tall and proud ships, so well armed in the beakehead with yron pikes and brazen tines; so offensive and dangerous to bouge and pierce any enemie ship which they doe encountre. Certes, reported it is, that in the naval battaile before Actium, wherein *Antonius*, and *Cleopatra* the queene, were defeited by *Augustus*, one of these fishes staied the admirall ship wherein *M. Antonius* was, at what time as he made all the hast and meanes he could devise with help of ores to encourage his people from ship to ship, and could not prevaile, untill he was forced to abandon the said admirall, and go into another galley. Meanwhile the armada of *Augustus Cæsar*, seeing this disorder, charged with greater violence, and soone invested the fleete of *Antonie.* Of late daies also, and within our remembrance, the like

[1] Donovan's *British Fishes*, t. lxviii.

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happened to the roiall ship of the emperor *Caius Caligula*, at what time as he rowed backe, and made saile from Astura to Antium; when and where this little fish detained his ship, and (as it fell out afterward) presaged an unfortunate event thereby: for this was the last time that ever this emperour made his returne to Rome: and no sooner was he arrived, but his own souldiours in a mutinie fell upon him and stabbed him to death. And yet it was not long ere the cause of this wonderfull staie of his ship was knowne: for so soon as ever the vessel (and a galliace it was, furnished with five bankes of ores to a side) was perceived alone in the fleete to stand still, presentlie a number of tall fellows leapt out of their ships into the sea, to search what the reason might be that it stirred not; and found one of these fishes sticking fast to the very helme: which being reported unto *Caius Caligula*, he fumed and fared as an emperour, taking great indignation that so small a thing as it should hold him back perforce, and check the strength of all his mariners, notwithstanding there were no fewer than foure hundred lustie men in his galley that laboured at the ore all that ever they could to the contrarie. But this prince (as it is for certain knowne) was most astonied at this, namely, that the fish sticking only to the ship, should hold it fast; and the same being brought into the ship and there laid, not worke the like effect. They who at that time and afterward saw the fish, report that it resembled for all the world a snaile of the greatest making: but as touching the form and sundrie kinds thereof, many have written diversly, whose opinions I have set downe in my treatise of living creatures belonging to the waters, and namely in the particular discourse of this fish: neither doe I doubt but all the sorte of fishes are able to doe as much: for this we are to believe, that Pourcellans also be of the same vertue, since it was well knowne by a notorious example, that one of them did the like by a ship sent from *Periander* to the Cape of Gnidos: in regard whereof, the inhabitants of Gnidos doe honour and consecrat the said Porcellane within their temples of *Venus*. Some of our Latin writers do call the said fish that thus staieth a ship, by the name of Remora."

Another species, *Echeneis Naucrates*, Linn. (Plate CCCV. fig. 10), commonly called the Indian Remora, has usually twenty-two plates upon the head. In its habits it resembles the preceding; but it seems to be more frequent in the seas of India and America, than in those of Europe. The manuscripts of Commerson, as quoted by Count Lacépède, inform us that it is common along the coasts of Mosambique, where it is made use of in a singular way for the purpose of catching turtles. A ring is first fastened round its tail, and then a long cord is attached to the ring. When thus accoutred, the fish, placed in a vessel of seawater, is carried out in a boat; and as soon as the fishermen perceive a sleeping turtle, they row gently towards it, and throw the remora into the water, with a sufficient length of cord. It seldom fails speedily to attach itself to the unconscious turtle, which by the tenacity of its adherence is immediately drawn towards the boat and captured.

A third species of remora is described by Mr Archibald Menzies as an inhabitant of the Pacific Ocean.[1] He has named it *Ech. lineata*. It is distinguished by having only ten transverse plates to its sucker. Mr Menzies found it adhering to a turtle. A fourth species (and these are all with which we are acquainted) has been more recently discovered by Baron Cuvier. The rays of its pectoral fins are bony, compressed, and terminated by a slightly notched *pallete*. He names it *Echeneis osteochir*.[2]

ORDER IV.—MALACOPTERYGII APODES

Malacopterygii Apodes. Anguilliformes.

which may be considered as constituting a single natural family, the

ANGUILLIFORMES,

or fishes with an elongated shape; a thick skin, on which scales are in general but indistinctly visible; and without *cæca* to their intestines. Almost all are provided with a swimming bladder, which often assumes a remarkable form.

The ancient unrestricted Genus Muræna of Linnæus is distinguished by the snake-like form of the body; the small opercles covering concentric branchiostegous rays, buried in the skin, and only opening posteriorly by a sort of tubular orifice. This structure, by giving a more perfect command over the closure of the gills, enables them to remain longer out of water without injury than the generality of fishes. They have scarcely-perceptible scales, which are concealed in a tough skin, covered with a slippery mucus. They all are destitute of ventral fins and cæca, and have the anus placed very far behind. Numerous subdivisions of the old genus *Muræna* have taken place in modern times. We shall here note the following:

Genus Anguilla, Thunberg and Shaw. Eels in general, as distinguished from *Murænæ*, are characterised by the possession of pectoral fins, under which the branchial aperture opens; their swimming bladder has an elongated shape, and near its middle a peculiar glandular body; their stomach has a long cul-de-sac; their intestine is almost straight.

The more restricted genus Anguilla, or *eel properly so called*, has the dorsal and caudal fins continued around the tail, giving it a pointed form.

In the *true* eels, the dorsal begins a considerable distance behind the pectorals. Some have the upper jaw shorter than the lower; such as the *Anguilla vulgaris*, or common eel. (Plate CCCVI. fig. 1.) This fish is universally distributed, and scarcely requires description. The usual colour is an olive tint above, and a silvery colour below; but in some instances the back is spotted with brown. We have observed these fish in considerable numbers leaving fresh-water lakes in the night time, and frequenting meadows, seemingly for the purpose of preying on slugs and snails. They easily move on the land, with a motion resembling that of snakes. The eel grows to the size of two or three feet, and is sometimes said to reach five or six feet in length. It abounds in many European rivers. Eels are caught in immense numbers in the rivers emptying themselves into the Baltic; and they form a considerable article of trade. Two thousand are stated to have been caught at one sweep in Jutland; and in the Garonne 60,000 were taken in one day by a single net.

"That eels migrate towards brackish water," observes Mr Jesse, "in order to deposit their roe, I have but little doubt, for the following reasons. From the month of November until the end of January, provided the frost is not very serious, eels migrate towards the sea. The Thames fishermen are so aware of this fact, that they invariably set their pots or baskets with their mouths up stream during those months, while later in the spring and summer they are set down stream. The best time, however, for taking eels, is during their passage towards the sea. The eel-traps, also, which are set in three different streams near Hampton Court (the contents of which, at different times, I have had opportunities of ex-

[1] *Linn. Trans.* vol. i. p. 187, pl. xvii.

[2] *Règne Animal*, t. ii. p. 348.

amining), have invariably been supplied with eels sufficiently large to be breeders, during the months I have mentioned. This migratory disposition is not shown by small eels; and it may therefore be assumed that they remain nearly stationary till they are old enough to have spawn. I have also ascertained that eels are taken in greater or lesser numbers during the months of November or December, all the way down the river to the brackish water. From thence the young eels migrate, as soon as they are sufficiently large and strong to encounter the several currents of the river, and make their way to the different contributary streams. I have also been able to trace the procession of young eels, or, as it is called here, the *eel-fair*, from the neighbourhood of Blackfriar's Bridge, as far up the river as Chestrey, although they probably make their way as far, or farther than Oxford. So strong, indeed, is their migratory disposition, that it is well known few things will prevent their progress, as, even at the locks at Teddington and Hampton, the young eels have been seen to ascend the large posts of the flood-gates, in order to make their way, when the gates have been shut longer than usual. Those which die stick to the posts; others, which get a little higher, meet with the same fate, until at last a sufficient layer of them is formed to enable the rest to overcome the difficulty of the passage. A curious instance of the means which young eels will have recourse to, in order to perform their migrations, is annually proved in the neighbourhood of Bristol. Near that city there is a large pond, immediately adjoining which is a stream. On the bank between these two waters a large tree grows, the branches of which hang into the pond. By means of these branches, the young eels ascend into the tree, and from thence let themselves drop into the stream below, thus migrating to far distant waters, where they increase in size, and become useful and beneficial to man. A friend of mine, who was a casual witness of this circumstance, informed me that the tree appeared to be quite alive with these little animals. The rapid and unsteady motion of the boughs did not appear to impede their progress."[1]

"All authors agree," adds Mr Yarrell, "that eels are extremely averse to cold. There are no eels in the arctic regions, none in the rivers of Siberia, the Wolga, the Danube, or any of its tributary streams. It is said there are no eels in the Caspian or Black Seas, but they abound in the Mediterranean; and M. Risso has described eight species in his work on the Natural History of the Environs of Nice. There is no doubt, also, that fishes in general, and eels more particularly, are able to appreciate even minute alterations of temperature in the water they inhabit. The brackish water they seek to remain in during the colder months of the year, is of a higher temperature than that of the pure fresh water of the river, or that of the sea. It is a well-known law in chemistry, that when two fluids of different densities come in contact, the temperature of the mixture is elevated for a time, in proportion to the difference in density of the two fluids, from the mutual penetration and condensation. Such a mixture is constantly taking place in rivers that run into the sea, and the temperature of the mixed water is accordingly elevated."[2] As eels are well known to breed in ponds, it may be inferred that their descent to the brackish water, though customary, is not indispensable. They sometimes attain a great size. The species (or variety) called the *sharp-nosed silver eel* has been taken near Cambridge of the weight of twenty-seven pounds.

Some authors make a separate division of the Congers (*Conger*, Cuv.), which chiefly differ from the common eels in having the upper jaw the longest, and the dorsal fin commencing almost over the pectorals. The chief species are the following: *Anguilla conger* (Plate CCCVI. fig. 3) grows to the size of six feet or more, and is as thick as a man's leg. The conger is found around all our coasts. The skin has a leaden hue above, and is white below, with darker spots along the sides. The dorsal is bordered with black. The teeth are sharp, and when captured the fish is capable of giving very severe bites. The fishermen are stated also to dread injury to their legs from a large conger twining round them. It has been said to attack swimmers by coiling round them, and preying on their bodies. It is voracious, and has not unfrequently been found within the carcasses of dead animals, on which it was evidently feeding. The conger fishery was at one time of some consequence on the Cornish coasts, for the supply of Spain and Portugal. The fish were cured by drying, during which they lost much fat. *Anguilla myrus* (Rondelet) has a sharp snout, a thin roundish body of a dark colour, without spots, except toward the head, where a few yellowish dashes are seen; as also a whitish transverse band on the occiput, and two rows of small specks on the back of the neck. This species occurs in the Mediterranean, as do several other small congers, such as *A. balearica*, *mystax*, and *nigra*. The last named lives among the rocks near Nice, and attains to the weight of forty pounds. Its flesh is more esteemed than that of the common kind.

The Genus Ophisurus, or *snake-tail*, differs from the eels properly so called, by the dorsal and ventral fins terminating abruptly before reaching the extremity of the tail, which is thus deprived of fin, and ends in a sharpened point. The intestine resembles that of the eels; but a portion of it extends into the tail, farther back than the anus. The teeth are sharp and cutting. *Ophisurus serpens* is a Mediterranean species, marked by a triple chain of large, dark-brown, oblong spots, on a silvery-white body. It grows to the length of six feet, and is as thick as the human arm. The snout is sharp; the branchial membrane has twenty rays. *Ophisurus guttatus*, a handsome species from Guyana, belongs to this subdivision; as does *O. ophis*, the *Muræna ophis* of Bloch. In some Ophisuri the pectoral fins are small, and sometimes almost imperceptible; a circumstance which assimilates them to the *Murænæ*. Such are *O. colubrinus*, *fasciatus*, and *maculosus*.

Genus Muræna, Thunberg. The species were united by Linnæus to the eels; but they are distinguished sufficiently by the total want of pectoral fins. Their branchial apertures are minute lateral holes; their opercles are so small, and their branchiostegous rays so slender, and so concealed within the skin, that some able naturalists have denied their existence in this genus. Their stomach is a short pouch; and their swimming bladder is small, oval, and placed towards the upper part of the abdomen. Some of them have the dorsal and anal fins distinctly visible; some have obtuse, others sharp cutting teeth, and the latter can bite severely.

The best known is *Muræna Helena*, or *Roman muræna* (Plate CCCVI. fig. 2), which abounds in the Mediterranean, and was introduced by the luxurious Romans of antiquity, in crystal vases, to the table before being cooked, that the guests might admire its variegated skin. This fish is very voracious, and feeds on all sorts of animal matter. The Romans fed them in ponds, and Pliny has recorded the atrocities of Vedius Pollio, who used to punish his offending slaves by throwing them alive to his murænæ. We have seen this fish repeatedly taken at

[1] *Gleanings in Natural History*, second series.

[2] *Ibid.*

Malacopterygii Apodes. Anguilliformes.

Gibraltar, between three and four feet in length. The skin is beautifully marbled with yellow sub-angular markings on a rich brown ground. When captured in nets it lives long out of the water, and is capable of biting very severely, from the sharpness of its numerous teeth. A very beautiful muræna with obtuse teeth, *M. catenata*, is found in the rivers of Guyana; its colours are brown and white. In the same region is found *M. zebra*, a species beautifully marked, on a dark-brown ground, with transverse, linear, distant bands, meeting irregularly beneath. Other species are, *M. reticularis*, *M. punctata*, *M. unicolor*, *M. Haüy*, *M. picta*, *M. meleagris*, *M. grisea*, *M. afra*, *M. stellata*, *M. undulata*, *M. sordida*.

Genus Sphagebranchus, Bloch. This genus differs from *Murœna* chiefly in having the branchial apertures close together, and beneath the throat, instead of being on each side of the neck. The snout is sharp, and projecting far beyond the mouth; the dorsal and anal fins, when perceptible, do not commence until within one third of the length of the fish from the extremity of the tail. Some of them have no appearance of pectoral fins; others have slight vestiges of those parts. One of them, *Sph. cœcus* (Genus *Apterichtes*, Dumeril), is absolutely without any fins at all. The stomach has a long cul-de-sac; the intestine is straight; and all have a long narrow swimming bladder placed towards the posterior extremity.

The best known is *Sphagebranchus rostratus*, first noticed by Bloch. It grows to a length of nine inches. *Sph. imberbis* was described by Laroche in *Ann. du Mus.* xiii. as well as *Sphag. cœcus*, which he considered as a muræna.

Genus Synbranchus, Bloch. This division is distinguished from the last by having only a single branchial orifice, which is placed under the throat, and communicates with the gills on each side. The fishes included in it are totally without pectorals, and their vertical fins are almost entirely adipose. Their head is thicker than any part of the body, and short; the mouth is wide, lips fleshy, teeth small, conical, and in several rows. Their opercles are partly cartilaginous; their branchial rays are very strong; their swimming bladder is long and narrow. They have no cæca to the intestine, which is straight, and can scarcely be distinguished from the stomach except by a kind of pyloric valve. The species inhabit the seas of the hotter parts of America, especially Surinam. Two only are known, *Synbranchus marmoretus* (Plate CCCVI. fig. 4) and *Syn. immaculatus*. They have much the habit of water-snakes.

In succession to the preceding generic subdivisions of the Linnæan *Murænæ*, Cuvier places a singular and recently discovered species, the *Saccopharynx flagellum* of Dr Mitchell. Its body is capable of great inflation. It is a large and voracious fish, measuring about six feet in length, with a deep cleft mouth armed with sharp teeth. It has hitherto been found only in the Atlantic Ocean, where it floats on the surface by means of the inflation just alluded to.[1]

Genus Gymnotus, Linn. The gymnotes, like eels, have the gills partly shut up by a membrane, which, however, opens before the pectoral fins; the anus is placed near the head; the anal fin runs along nearly the whole under part of the fish, and generally reaches to the extremity of the tail, but is not continued along its upper portion.

In Gymnotus, Lacép. *properly so called*, the skin is without visible scales; the intestine, in several convolutions, occupies but a moderate space, and has many cæca; the stomach is a short, blunt sac, with numerous rugæ within. Some of them have two swimming bladders; the anterior is ovate and bilobular, and lies on the œsophagus, at the top of the abdomen; the posterior is cylindrical, and occupies a sinus in the abdominal cavity. The true gymnotes are confined to the rivers of America. The best-known species is *Gymnotus electricus*, or electric eel (Plate CCCVI. fig. 5). This animal has been well described by Dr Garden of Charlestown, by John Hunter, and by Humboldt. It is remarkable for the violence of its electric shocks, which are often so powerful as to stupify a man or a horse. The researches of Hunter detected an organ in the posterior part of this fish, resembling the electric apparatus of the torpedo. See Plate CCCVI. fig. 6. This organ consists of four longitudinal fasciculi, which occupy one half the thickness of the part in which they occur, and about one third of the whole animal. The larger pair lie above, the smaller below. Each fasciculus is composed of flat partitions or septa, with transverse divisions between them. The outer edge of the septa appear in nearly parallel lines in the direction of the longitudinal axis of the body, and consist of thin membranes, which are easily torn; they serve the same purpose as the columns in the analogous organ of the torpedo, making the walls or abutments for the perpendicular and transverse dissepiments, which are exceedingly numerous, and so closely aggregated as to seem almost in contact. The minute prismatic cells, intercepted between these two sorts of plates, contain a gelatinous matter; the septa are about one thirtieth of an inch from each other, and one inch in length contains a series of 240 cells, giving an enormous surface to the electric organs. The whole apparatus is abundantly supplied with nerves from the medula spinalis; and these nerves are seen coming out in pairs from between the vertebræ. In their course they give out branches to the muscles of the back, and to the skin of the animal. In the gymnote, as in the torpedo, the nerves supplying the electric organs are much larger than those bestowed on any part for the purposes of sensation or movement. Hunter thinks, however, that these nerves are more considerable in point of size in the torpedo than in the gymnote. These organs are attached loosely to the muscles of the back which lie between the larger, and they are immediately connected with the skin by a loose cellular texture. Humboldt has given a very interesting and lively description of the mode of capturing the electric gymnote, as practised in South America, near the town of Calabozo.

These fish abound in the stagnant pools of that vicinity. The Indians are well aware of the danger of encountering the gymnote when its powers are unexhausted. They therefore collect twenty or thirty wild horses, force them into the pools, and when the fish have exhausted their electric batteries on the poor horses, they are laid hold of without difficulty. The horses at first exhibit much agitation and terror; they are prevented leaving the pool by an enclosing band of Indians, who goad them with bamboos whenever they attempt to escape. "The eels," says Humboldt, "stunned and confused by the noise of the horses, defended themselves by reiterated discharges of their electric batteries. For some time they seemed likely to gain the victory over the horses and mules; these were seen in every direction, stunned by the frequency and force of the shocks, to disappear under water. Some horses, however, rose again, and, in spite of the active vigilance of the Indians, gained the shore, exhausted with fatigue; and their limbs being benumbed by the electric explosions, they stretched themselves out upon the ground." "I remember the superb picture of a horse entering a cavern,

[1] *Ophiognathus ampullaceus* of Mr Hardwood, *Phil. Trans.* 1827, seems to pertain to the same genus.

and terrified at the sight of a lion. The expression of terror is not there stronger than what we witnessed in this unequal conflict. In less than five minutes two horses were already drowned. The eel, more than five feet long, glides under the belly of the horse or mule; it then makes a discharge from the whole extent of its electric organs, which at once attacks the heart, the viscera, and especially the gastric plexus of nerves." "After this commencement, I was afraid that the sport might end very tragically. But the Indians assured us that the fishing would soon be finished, and that nothing is to be dreaded but the first assault of the gymnotus. In fact, whether the galvanic electricity is accumulated in repose, or the electric organ ceases to perform its functions when fatigued by too long-continued use, the eels, after a time, resemble discharged batteries. Their muscular motion is still equally active, but they no longer have the power of giving energetic shocks. When the combat had lasted a quarter of an hour, the mules and horses appeared less affrighted; they no longer bristled up the mane, and the eye was less expressive of suffering and of terror. They no longer were seen to fall backwards; and the gymnotes, swimming with the body half out of the water, and now flying from the horses instead of attacking them, began themselves, in their turn, to approach the shore."

The electric gymnote is by no means fierce or voracious; but its electric organs are the instruments by which it procures its prey, and defends itself against alligators and other enemies.

It has been several times brought alive to Europe, and some experiments have been made on its electricity,—which is conducted and insulated by the same substances as common galvanism.[1]

So common is the gymnotus in some parts of South America, that, in the neighbourhood of Uritucu, a route at one time much frequented has been entirely abandoned, in consequence of the necessity of fording a stream, in which many mules were killed every year by these subaqueous electric shocks.

The only other known species of gymnotus is the *G. æquilabiatus* of Humboldt, which appears to differ from the other in wanting the posterior swimming bladder.

The Genus Carapus was separated by Cuvier from the gymnotes, with which they were formerly confounded; and the species are distinguished by a scaly compressed body and a slender tail. The appellation is derived from their Brazilian name. All the species live in the rivers of South America, or on the coasts of that country. *Carapus macrourus* grows to the length of eighteen inches or two feet, and is of a brown colour, with small eyes, and slender tail. *C. brachiurus vel fasciatus* is marked with darker transverse bands. *C. albus* is of a whitish colour; tail naked for about an inch; upper lip with a lobule on each side; several pores on the sides of the head. *C. rostratus* has a body like that of *C. macrourus*, but the snout is narrow, compressed, and tubular, with connate jaws; colour pale brown, variegated with darker spots; the scales not visible.

The Genus Sternarchus of Schneider was so denominated from the anus being near the sternum. The anal fin ends before it reaches the extremity of the tail, which has a fin of its own; but the most singular character in the structure of this fish consists of a soft fleshy filament, concealed in a furrow on the dorsum, beyond the middle of the back, and retained in this groove by tendinous threads, which admit of its having some motion; a very singular organ, of which we cannot conjecture the use. The head is oblong, naked, and compressed; neither opercula nor branchial rays are externally visible; the rest of the body is scaly; the teeth are soft, short filaments, like velvet, on the middle of each jaw. The only species is *Sternarchus albifrons*, which was considered by Pallas, its first describer, as a *Gymnotus*.

Genus Gymnarchus, Cuv. Body scaly and elongated, gills but slightly open in front of the pectorals, as in Gymnotus, but the back is furnished all along with a soft rayed fin; there is no fin behind the anus, nor beneath the tail, which has a pointed termination. The head is conical, naked,—the mouth small, and provided with a single row of small cutting teeth.

Gymnarchus Niloticus of Cuvier, discovered by M. Riffault, is, as its name implies, an Egyptian fish, and is, we believe, the only known species.

Genus Leptocephalus, Pennant. This genus differs from the eels by being greatly compressed laterally, by a larger branchial aperture opening before the pectorals, by a head extremely small, and a pointed snout. The pectorals are almost invisible; the dorsal and anal are very small, and unite at the point of the tail. The intestines occupy a narrow line along the inferior margin of the body.

Only one species is known, a native of our own seas, first described by Pennant. It is the *Leptocephalus Morrisii*, a small fish of four inches long by one tenth of an inch in thickness, and so transparent as almost to exhibit the form of the vertebræ, which may also be felt through the integuments. This singular creature was first seen near Holyhead by Mr William Morris, who transmitted it to Pennant. Though still a rare species, it has since been observed by several other British naturalists.

Genus Ophidium, Linn. This genus has the anus far behind; the dorsal and anal fins join in a point at the tail; the body is long and compressed, and covered with small irregular scales, scattered in the thickness of the skin. But these fish differ from eels, in having open gills, furnished with a large operculum, and a branchiostegous membrane, with short rays. The dorsal rays are articulated, but not branched.

The genus is subdivided into two sub-genera, viz. *Ophidium proper*, in which the throat is provided with two cirrhi adhering to the point of the os hyoides. The best-known species is *Ophidium barbatum*, which grows to eight inches; general colour silvery, but the vertical fins banded with black; the surface smooth, scales attached by their centre to the skin; two bifid cirrhi on the throat; skin spotted with small red spots. The swimming bladder is oval, large, and thick, for the size of the fish, and is supported by three peculiar bones suspended under the first vertebra, and moveable by particular muscles. This fish abounds in the Mediterranean, where it is in request as an article of diet. *Ophidium Vassali* is a small species, also found in the Mediterranean; but in the South Seas a large species has been caught. It is named *Oph. blacodes*. Enchelyopus (Fierasfer), Klein, differs in wanting the beards of the true Ophidium. The dorsal fin is so slight as only to seem a fold of the skin; the swimming bladder has but two supporting bones. Only one species is recognised, *Ophidium imberbe* of Linn., which is also *Gymnotus acus* of several naturalists. As a British species, it was first communicated to Pennant by the Duchess of Portland, from Weymouth. It has since been found by Montagu on the south coast of Devon.

[1] Dr Traill informs us that he had two sent to him from Demerary, but they died the day before the ship made the coast of England, and were unluckily thrown overboard.

Genus Ammodytes, Linn. Has a thin and elongated form. The dorsal fin is furnished with articulated rays, but is simple for a considerable part of its extent. There is a second fin behind the anus, and a third at the end of the tail, which is forked. These three fins are quite distinct, or separate from each other. The snout is pointed; the upper jaw susceptible of extension, but the lower is longer than the upper when the latter is not extended. The stomach is angular and fleshy; there is no swimming bladder nor cæca. Only one British species is as yet distinctly known, the *Ammodytes tobianus* (our common launce), a fish about eight or ten inches long, the body somewhat of a square form, but the angles not sharp, and the sides slightly convex. It is very frequent on our sandy coasts. Its back is bluish, the rest rich silvery. This fish lives on vermes and other marine animals, which it is believed to pursue by burrowing in the sand, from whence it is often dug up at the depth of a foot. It is prized as food, and is considered as an excellent bait for turbot and mackerel. It is the favourite prey of the latter fish; and the porpoise ploughs up the sand at the bottom of the sea with his nose, in the manner of a hog, in search of this species, which has often been found in his stomach. It is also sought for by salmon, which have been captured in the sandy bays of Sutherland, by means of a hook baited by a launce, commonly called the *sand-eel.*

It is extremely probable that two British species are usually confounded by us under the name of launce.[1]

The various genera of fishes with which we have been hitherto engaged, not only possess an osseous or fibrous skeleton, and free and complete jaws, but their branchiæ are constantly pectiniform, that is, in the shape of laminæ or combs. We now proceed to others, in which the respiratory organs assume another form.

ORDER V.—LOPHOBRANCHII.

Jaws complete and free, as in the preceding orders, but the branchiæ, instead of being comb-shaped, are divided into little rounded tufts, disposed in pairs along the branchial arches. The branchiæ have this further peculiarity, that they are entirely enclosed beneath a large operculum, attached all round by a membrane, which permits the water to escape merely through a small hole, and exhibits only vestiges of rays.

The genera of this order may be distinguished externally by the *cuirassed* aspect of their bodies, which are strongly plated, very angular, and frequently furnished with spiny projections. The species are meagre creatures, of small size, and very extraordinary aspect. They have scarcely any *flesh* upon their bones. The intestine is uniform, and without cæca; the swimming bladder is thin, but tolerably large in proportion to the other parts. The order is almost entirely composed of the old genera *Syngnathus* and *Pegasus* of Linnæus.

The genus Syngnathus of the great Swedish naturalist consisted of a rather numerous assemblage of species, distinguished by a tubular muzzle, formed, like that of the Fistularidæ, by a prolongation of the ethmoid, vomer, and tympanic bones, of the pre-opercles, sub-opercles, &c. and terminated by a mouth of the ordinary kind, but almost vertically cleft. The respiratory opening is towards the nape of the neck, and the ventral fins are wanting. The generative system is characterised by this peculiarity, that the eggs slip into, and are hatched in, a kind of sac or pocket, formed by a pursing of the skin—in some beneath the belly, in others at the base of the tail. This pouch opens in due time for the escape of the young. In this respect, then, these fishes may be said to connect the osseous with the cartilaginous kinds, for the eggs are hatched internally, and the young are produced alive. This fact was observed by Aristotle, and has lately been confirmed (so far, at least, as concerns *S. acus*) by Cavolini. The genus is now subdivided into three minor groups, as follows:—

1*st*, Genus Syngnathus properly so called. Body very long, thin, and differing but little in its diameter throughout. Several species occur in all our seas. They differ in the character and number of their fins.

2*d*, Genus Hippocampus, Cuv. Body laterally compressed, and obviously higher than at the tail. The surface is raised into ridges, its edges are angular and incised, and the hinder parts of the body and tail have the appearance of being divided into segments. The caudal fin is wanting.

Of this genus several species are found in the European seas, and one or two occur along the British shores. The greater number, however, are exotic. In the dried specimens the head is usually bent at right angles with the body, the thorax curved, and the tail bent inwards. From the peculiar aspect which they exhibit in this condition, they have received the name of *sea-horses.* The most remarkable species with which we are acquainted is the *Hippocampus foliatus* of Shaw, or foliated pipe-fish. (See Plate CCCVI. fig. 7.) This rare and very singularly constructed fish is a native of the Southern Ocean. The specimen described by Shaw was transmitted from New Holland to Sir Joseph Banks. The one here figured was sent to Professor Jameson from Van Diemen's Land. We should not have hesitated to consider this species as synonymous with *S. tæniolatus* of Lacépède (and the more readily as they seem to be regarded as identical by Cuvier[2]); but on comparing it with the figure in the *Annales du Mus.* we find that the Van Diemen's Land specimen possesses two large appendages on the dorsal outline, not represented by the author of the earlier *Hist. Nat. des Poissons.*

3*d*, Genus Solenostoma, Seb. and Lacép. Differs from *Syngnathus* chiefly in possessing very large ventrals placed behind the pectorals, and united together and with the body so as to form a kind of apron, which, like the pouch of the genus just named, serves to retain the ova. There is also a dorsal, with few rays, but elevated, and placed near the nape; another very small fin on the origin of the tail; and a large pointed caudal. In other respects the genus bears a great resemblance to *Hippocampus.* There is only a single species known, the *Fistularia paradoxa* of Pallas.[3]

Genus Pegasus, Linn. Projecting muzzle formed by the same pieces as in the preceding genera, but the mouth, instead of being placed at the extremity, is found at the base, and, in its protractile nature, so far resembles that of the sturgeon, although it is composed of the same bones as the mouth of ordinary fishes.

The body in this genus is cuirassed like that of *Hippocampus* and *Solenostoma*, but the trunk is broad, depressed, the branchial opening lateral, and there are two distinct ventral fins behind the pectorals, which are often large and wing-like, and have given rise to the generic name. The dorsal and anal are opposite to each other. The species are chiefly from the Indian seas. See Plate CCCVI. fig. 10.

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[1] See *Règne Animal*, t. ii. p. 360; and *Bulletin des Sciences* for September 1824.

[2] *Règne Animal*, t. ii. p. 363.

[3] *Spicilegia*, viii. iv. 6.

Plectognathi. Gymnodontes.

ORDER VI.—PLECTOGNATHI.

The fishes of this order approach the great chondropterygian division in the imperfection of their jaws, and the slowness with which their skeleton hardens; yet that skeleton is fibrous, and its general structure resembles that of the ordinary or osseous fishes. The principal distinctive character, however, of the Plectognathi, consists in the maxillary bone being soldered or firmly attached on the side of the inter-maxillary, which alone forms the jaw, and in the palatine arch being connected by suture with the cranium, which consequently renders it immoveable. Moreover, the rays and opercles are concealed beneath a thick skin, which permits only a small branchial cleft to be visible externally. The vestiges of ribs are very slight. The true ventrals are wanting. The intestinal canal is ample, but without cæca, and almost all the species are provided with a rather large swimming bladder.

The order comprises two very natural families, characterised by the different armature of the jaws.

FAMILY I.—GYMNODONTES.

Instead of apparent teeth, the jaws are furnished with a substance like ivory, divided internally into laminæ or plates, the totality of which resembles the beak of a parrot, and is essentially composed of true teeth united together, and succeeding each other as they become used by trituration. The opercles are small, their rays five in number on each side, and the whole greatly concealed. The species live on Crustacea and Fuci. Their flesh is in general mucous, and slightly esteemed. Some indeed are even poisonous, at least during certain seasons.

Two of the genera (*Tetraodon* and *Diodon*), commonly called orbs or balloon-fish, possess a singular faculty of inflating their bodies by swallowing great quantities of air. When thus swollen, they roll over and float upon the surface, belly uppermost, apparently unable to direct their course. They are not, however, defenceless, for the spines with which their skin is armed project in all directions. Their swimming bladder has two lobes, and their kidneys, which are placed very high up, have been sometimes mistaken for lungs. There are but three branchiæ on each side. Each nostril is furnished with a double fleshy tentaculum.

Genus Diodon, Linn. The undivided jaws exhibit but one piece above and another below,—from whence the generic name, which signifies *two teeth*. Behind each cutting edge is a rounded portion, transversely grooved, and forming a powerful instrument of mastication.[1] The skin is armed on all sides by strong, pointed spines, so that, when inflated, these creatures bear a resemblance to a gigantic burr of a chestnut tree.

The species are numerous in the warmer seas. One of the most common is the *Diodon atinga* of Bloch, which measures about a foot in diameter. It inhabits the seas of India, America, and Southern Africa, and feeds on the smaller fishes, Crustacea, and shell-fish, the calcareous covering of which it breaks with great facility, by means of its robust and bony jaws. It is a dangerous species to meddle with, owing to the sudden and hedgehog-like manner in which it bristles up its spines. It seems synonymous with *D. hystrix* of Linn., commonly called the sea-porcupine, and was formerly a frequent and dusty appendage in the shop of the apothecary. (See Plate CCCVI. fig. 8.) *Diodon holocanthus* inhabits almost all the seas between the tropics. When taken by means of a hook, it exhibits the most ungovernable movements,—alternately inflates and compresses its body, ascends and descends with rapidity and violence, and is extremely dangerous to lay hold of. It is fished for both in the Red Sea and along the coast of Japan; and, according to Dutertre, the hooks are baited with Crustacea. The bait, it appears, is first approached with caution, then tasted, left, returned to, and finally swallowed. It no sooner, however, finds itself fairly hooked, than it swells itself up like a balloon, utters a dull sound like that produced by a turkey-cock while making its wheel, and then becomes exceedingly furious. It next has recourse to an opposite mode of action, by lowering its spines, disinflating its body, and becoming as loose and flabby as a wet glove.[2] It resumes its activity, however, as soon as it perceives the fisherman drawing towards it, or feels itself being drawn towards the fisherman. In short it has a particular dislike to being killed.

Genus Tetraodon, Linn. Jaws divided in the centre by a suture, so as to exhibit the appearance of four teeth (from whence the name), two above and two below. The skin is armed merely by small spines, which project but little. Several species are regarded as poisonous.

The most anciently known is an Egyptian species, *T. lineatus*, Linn., which is thrown by the floods in vast numbers over the prolific banks of the Nile, where it is afterwards gathered as a plaything by the children. According to Hasselquist, however, the Egyptians hold it in abhorrence, and believe that the use of its flesh as food is followed by death. The prickles of its skin produce a sensation like the stinging of nettles. In many Mahommedan countries another species, called *T. hispidus* by Lacépède, is fully inflated, then carefully dried, and afterwards suspended from the pinnacle of the minarets, where it serves the purpose of a weathercock. The hare tetraodon, as it is called (*T. lagocephalus*, Linn.), appears to have been described by Pennant under the title of *Globe Diodon*. Though a tropical species, it has occurred occasionally along the British coasts, particularly near Penzance in Cornwall. We here figure a curious Indian species, the *Tetraodon patoca* of Dr Hamilton Buchanan. Plate CCCVI. fig. 9.

Baron Cuvier has separated from the preceding, under the generic title of Orthagoriscus (imposed by Schneider, and synonymous with genus *Cephalus* of Shaw), the peculiar species known to English readers under the name of *sun-fish*, the *Poissons-lunes* of our continental neighbours.[3] The jaws are undivided, as in *Diodon*, but the body, compressed and without spines, is unsusceptible of inflation, and the tail so short, and vertical in its posterior outline, as to convey the idea of an artificial truncation. The form is in consequence extraordinary and characteristic. The dorsal and anal fin, each high and pointed, seem to unite with the caudal. The swimming bladder is wanting, the stomach small, and penetrated directly by the *ductus choledocus*. Beneath the skin we find a thick layer of a gelatinous nature. The European seas produce a species which sometimes measures more than four feet in length, and weighs, in consequence of its bulky proportions, above three hundred pounds. It is of a fine silvery hue, and is named *Tetraodon mola* by Linnæus, and the *short sun-fish* by British writers. (See Plate CCCVI. fig. 11.) It often exhibits during the night a high

[1] Baron Cuvier observes, that the jaws of these fishes are by no means unfrequent among petrifactions.

[2] Griffith's *Animal Kingdom*, vol. x. p. 581.

[3] The title of *Poisson-lune* is however bestowed also on other species by French writers, for example on *Lampris guttatus* of Retzius, which is the *Zeus luna* of Gmelin, and the *Opah* of Pennant.

degree of phosphoric splendour. We once came alongside of one while swimming in the Mediterranean. It got out of our way by sinking very slowly downwards. The *Diodon mola* of Pallas (*Spic. Zool.*) is another species of the same genus.

The only remaining genus of the first family of Plectognathi is named Triodon by Cuvier, from a species discovered in the Indian seas by M. Reinward.[1]

FAMILY II.—SCLERODERMI.

Easily distinguished by the conical or pyramidal form of the muzzle, prolonged from the region of the eyes, and terminated by a little mouth armed with a small number of distinct teeth on each jaw. The skin is generally rough, or covered by hard scales. The swimming bladder is large and robust, and of an oval form.

Genus Balistes, Linn. Body compressed; eight teeth upon a single row on each jaw, and generally of a cutting kind; skin scaly or engrained, but not absolutely osseous; first dorsal composed of one or more spines, articulated on a special bone, which is attached to the cranium, and presents a groove into which the spines are received; second dorsal soft and long, and corresponding in its position to an anal fin of nearly similar form. Although the ventral fins are wanting, we nevertheless perceive in the skeleton a true pelvic bone suspended to those of the shoulder.

The species occur in vast numbers in the torrid zone, among rocks nearly on a level with the surface of the water, where they shine with a brilliant lustre resembling that of the beautiful chætodons, formerly described. Their flesh, at no time much esteemed, is said to become dangerous as food while they themselves are nourished by the polypi of the coral reefs. Cuvier however states, that in such specimens as he had occasion to dissect, he found nothing but the remains of marine vegetation. The generic name is derived from *balista*, an ancient implement of war, to which the inclined dorsal spine has been regarded as bearing some resemblance. In modern times the original genus has been divided into the four following groups.

In Balistes (properly so called) of Cuvier, the whole body is clothed by large, hard, rhomboidal scales, which not being imbricated, or encroaching on each other, present the appearance of compartments on the skin; their anterior dorsal has three spines, of which the first is much the largest, the third being very small, and placed somewhat apart behind. The extremity of the pelvis is always prickly and projecting, and behind it are some spines involved in the skin, which in the lengthened species have been regarded as rays of the ventral fins. Some have no particular armature on the sides of the tail; others have the lateral portion of that part armed by a certain number of ranges of spines curved forwards.

In Monocanthus, Cuv., the scales are very small, and beset by close asperities; the extremity of the pelvis is projecting and spiny, as in the preceding group, but there is only one large dentated spine to the first dorsal, or, if the second exists, it is almost imperceptible.

In Aluteres, Cuv., the body is elongated, and covered by scarcely visible, small, close-set grains; there is a single spine to the first dorsal; and the pelvis is entirely subcutaneous, not forming that spiny projection visible in the other *Balistes*. See Plate CCCVI. fig. 12.

In Triacanthus, Cuv., the species are distinguished by possessing a kind of ventral fins, each sustained by a large single spiny ray, and adhering to an unprojecting pelvis. The first dorsal, posterior to its principal spine, has three or four smaller ones. The skin is covered by small, close-set scales, and the tail is more elongated than in the other groups. There is only one species known, a small fish from the Indian seas, figured by Bloch (148, 2) under the name of *Balistes bi-aculeatus*.

Genus Ostracion, Linn. Instead of scales, the species of this genus have the head and body covered by regular and bony compartments, soldered together so as to form an inflexible cuirass, which leaves nothing moveable but the tail, fins, mouth, and a small lip which borders the gills. The majority even of the vertebral joints are also as it were soldered. Each jaw is armed with from ten to twelve conical teeth. The branchiæ open only by a small cleft, furnished with a cutaneous lobe; but internally they are provided with an opercle and six rays. Both the pelvic bones and ventral fins are wanting, and there is only a single dorsal and anal fin, each small of its kind.

These anomalous-looking fishes are sparingly supplied with flesh; but their liver is large, and yields an abundant supply of oil. Some are suspected of being poisonous. The species are called *trunk-fish* by our English writers. We here figure the horned trunk-fish, *Ostracion cornutus* of Linn. and Bloch, a native, like most of the genus, of the Indian and American seas. Plate CCCVI. fig. 13.

SECOND GREAT SERIES OF THE CLASS OF FISHES.

THE CHONDROPTERYGII, OR CARTILAGINOUS FISHES.

This division of fishes, by the peculiarities of the organs of hearing and generation in some genera, approaches to the class of reptiles; while others have a skeleton so defective, and such simplicity of organization, that we might almost arrange them with Vermes. We may thus consider them, says Cuvier, as bearing the same relation to the first series as the marsupial animals do to the other mammifera furnished with claws.

Their skeleton is distinctly cartilaginous, destitute of true bony matter, as the calcareous portion is not disposed into a fibrous structure, but is deposited in grains in a substance essentially gelatinous. The skull is composed of a single piece, and consequently is destitute of sutures, but possesses foramina, prominences, and fossulæ, like the cranium of other fishes. The facial articulations are also wanting; and it forms one of their characteristics to want the maxillary and inter-maxillary bones, which ordinarily support the teeth of the upper jaw; or they have only vestiges of these parts, while their functions are performed by bones analogous to the palatines or the vomer. In some the vertebral column, as in the lamprey, forms but a single piece; in others, as in certain rays, several vertebræ are joined together. The gelatinous inter-vertebral substance, which in other fishes communicates from one to another through a small foramen, is in several of this series a cord of equal thickness, perforating all the vertebræ. Yet their nervous system, connected with the organs of digestion, is as complete as in other fishes; and some of them have organs of copulation and generation quite as perfect as in the class of reptiles.

This series is divided into two orders; one distinguished by having the gills free, as in other fishes; the other with fixed branchiæ.

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[1] See *Règne Animal*, t. ii. p. 370; and Duperrey's *Voyage*, *Poissons*, No. 4.

ORDER I.—STURIONES, OR CHONDROPTERYGII WITH FREE BRANCHIÆ.

The few genera of this order approach to ordinary fishes, by their gills being attached only at one extremity. They have but one branchial aperture, which is very open; they have but one operculum, and are without rays to the membrane of the gills.

Genus Acipenser, Linn.; Sturgeon. The general form of this genus resembles that of the sharks; but they are distinguished by longitudinal rows of bony plates or bosses implanted on the skin; the head is defended by similar plates; the mouth is small, and, as in sharks, placed below the snout; the palatal bones are united to the maxillaries, and vestiges of the inter-maxillaries may be traced in the lips, while the mouth is capable of some degree of projection, by its position on a style with three articulations. Instead of teeth, the mouth is furnished with a sort of horny process on the jaws. The nostrils and eyes are on the sides of the head; the muzzle is furnished with vermiform cirrhi. There is no vestige of an external ear, but the labyrinth is perfect within the bones of the head. The dorsal fin is behind the ventrals, and the anal immediately below the dorsal. The caudal fin surrounds the extremity of the spine, and its upper lobe is longer than the lower. Internally there exists the spiral intestinal valve, and the pancreas forming a single mass; but we also find a very large and strong swimming bladder, communicating by a wide aperture with the gullet. They prey on the smaller fishes, in pursuing which they can exert much speed; but in the rivers they frequent they are said to search for Vermes in the oozy bottom, which they explore with their snout, like swine.

Sturgeons are marine fishes, but at certain seasons they ascend in vast numbers particular rivers, where they are the subject of extensive fisheries, particularly in the large rivers that disembogue themselves into the Black Sea and Caspian, and the rivers of France and Prussia; they abound also in the large rivers of North America, where the species appear to be peculiar to that continent.

The European species are—

Acipenser sturio, or common sturgeon. Its ordinary length is seven or eight feet, but sometimes they are caught exceeding sixteen feet. Snout pointed, and furnished with cirrhi; body gradually tapering, pentagonal, from the disposition of six longitudinal rows of hard, bony, radiated, and mucronated tubercles. Its skin, except the flat belly, is rough, from small plates of a similar form; mouth a transverse oval orifice; lips cartilaginous; tongue thick; gill-covers consisting of an oval radiated plate; pectorals oval; dorsal near the tail. Its flesh is white and delicate, resembling veal. Its roe forms common *caviar*. This fish was highly prized by the ancients, and is still an esteemed food.

Acipenser ruthenus, or sterlet, is the smallest of European sturgeons, rarely measuring more than three feet long. It is very numerous in the Volga and Ural, and is uncommon in the Baltic. The lateral tubercles are very numerous, and strongly carinated; those of the under part of the body are more flattened. The flesh resembles delicate veal, and the roe forms the most highly prized *caviar*. See Plate CCCVII. fig. 1.

Acipenser huso, or isinglass sturgeon, is the largest of the genus, sometimes attaining the length of from twenty to thirty feet, and weighing from 1500 to between 2000 and 3000 lbs. Its skin is much less tuberculated than the common sturgeon, and is covered with a viscid mucus; the snout and cirrhi are shorter. This species is chiefly found in the Caspian and Euxine, or the rivers that flow into those seas; but the large sturgeons sometimes caught in the northern seas appear also to belong to the same species. The best isinglass is formed of its air-bladder.

The following species, which are found in the rivers of North America, appear to be peculiar to that continent (See *Amer. Trans.* vol. i.): *Acipenser brevirostris*, *A. oxyrhynchus*, *A. maculosus*, and *A. rubicundus*. The last of these appears to be the American representative of the *A. ruthenus*, the preceding one of the *A. sturio*.[1]

Genus Polyodon, Lacép.; Spatularia, Shaw. This genus, which consists but of a single species, is at once recognised by the enormous prolongation of its snout, which has a dilated middle, something resembling the leaf of a tree when viewed from above. The habit of the body resembles the sturgeon; but the spinal column is formed of one piece, as in the lamprey. The upper jaw is formed of the maxillary and palate bones united together, and the pedicle of the mouth has two articulations; the mouth is small, and furnished with numerous minute teeth. The spiracle is wide, and covered by a very large, soft operculum, extending to the middle of the body. The intestine is provided with the spiral valve, so frequent among the Chondropterygii; but the pancreas exhibits the commencement of a subdivision into lobules. The existence of an air-bladder sufficiently distinguishes it from the *Squali*. It has only been found in the Mississippi, and does not exceed a foot in length.

Genus Chimæra, Linn. This genus has a strong affinity to the Squali in general shape, and in the position of the fins, but the gills have only one aperture on each side; yet, on inspecting more accurately, we see that the rays are attached by most of the edges, and that there are really five holes opening into the bottom of a general cavity. A rudiment of an operculum is found in the skin; the jaws are still less complex than in the Squali, for the upper jaw is represented only by the vomer, and the palate bones and tympana are merely rudimentary, attached to the sides of the muzzle. Instead of teeth, the mouth is furnished with undivided hard plates, of which four are above and two below. The snout resembles that of the shark, and also has regular ranges of pores. The first dorsal fin is armed with a strong spine, and is placed over the pectorals. The males, as in the Squali, are distinguished by the cartilaginous appendages of the ventral fins, divided into three branches, and have two spiny plates before the base of the ventrals. These fish have also on their front a fleshy caruncle, garnished with a group of small prickles. The intestine of this genus is short, and has a spiral valve. The female lays eggs of a large size and coriaceous consistence, flattened, and hairy. The only species is *Chimæra borealis*, or northern chimera. It is found in the Northern Ocean, where it is believed to feed on the numerous Mollusca and Crustacea of that sea. It is rarely taken, because it keeps much in deep water; but it has been occasionally caught among our northern islands, and is sometimes seen of the length of three or four feet. Its head is the thickest part of the body, whence it tapers uniformly to the tail. It is most common on the coasts of Norway, where its eggs are eaten, and the oil of its liver is used as a stimulant embrocation. It also occurs in the Mediterranean.

Genus Callorhynchus, Gronovius. Cuvier separates this from the last genus, to which it was united by Linnæus. It is distinguished by its snout terminating in a fleshy,

[1] In a quarto work published some time ago at Berlin (*Gettreue Darstellung*, &c.), containing figures and description of the various animals of use in Therapeutics, there is a *Monograph of the Sturgeons* by Messrs Brandt and Rutzeburgh. See *Annales des Sciences Nat.* for Feb. 1831, p. 223.

flattened process, something in the form of a hoe. The mouth is small, and below the snout. The second dorsal fin commences over the ventrals, and terminates opposite to the commencement of the lower part of the tail. The only known species inhabits the Southern Ocean. See Plate CCCVII. figs. 2 and 3.

ORDER II.—CHONDROPTERYGII WITH FIXED BRANCHIÆ.

Instead of having the gills free at their external edge, in this order we find them fixed all round; and in respiration water is emitted through as many apertures as there are intervals between the rays. Another peculiarity of this order consists in the small cartilaginous arches suspended from the soft parts at the outer edge of the branchiæ.

The Linnæan genera *Squalus* and *Raia* are the principal members of this order; but Cuvier and the later Ichthyologists have subdivided these into several genera, according to marked peculiarities in their anatomical structure.

FAMILY I.—SELACHII, OR PLAGIOSTOMI.

The palatal and post-mandibular bones support the teeth, while the bones corresponding to the jaws in other fishes are merely rudimentary. A single bone connects these jaws with the cranium, and represents at the same time tympana, jugal, and temporal bones. The os hyoides is attached to a single pedicle, and, as in ordinary fishes, supports the rays of the gills. The labyrinth is membranous, and included in the cartilaginous substance of the cranium; the sac attached to it does not contain, as in fishes, the porcelanous concretions, but masses that are easily pulverized. The pancreas has the form of a conglomerate gland. The intestinal canal is short; but one part of the tube is furnished internally with a spiral lamina, that seems intended to prevent the too rapid passage of the food.

The Selachii have pectoral and ventral fins; the latter placed behind the abdomen, and on the sides of the anus.

In some respects their sexual intercourse resembles that of Mammifera. The females have well-developed oviducts, which serve the purpose of a matrix in the species whose young are perfected within the body; while in others the ova are covered by a tough and horny envelope, to the formation of which a large gland surrounding each oviduct is subservient. These eggs, especially in the *Squali*, have the form of a parallelogram with long filamentous tendrils at each corner, intended for attaching the egg to Fuci or sub-marine rocks during the maturation of the young included animals. Many of these eggs are found in a female, but only two appear to be perfected at once. In these the fœtus is coiled up, and to its umbilical region is attached a large pyriform bag, of a white colour, by a slender tube. On opening this bag it is found filled with a yellowish, thin liquid, like the yolk of a hen's egg, intended for the nourishment of the fœtus. When the young animal becomes able to collect its own food, the coriaceous egg opens at one end, the creature escapes, and soon the bag, now empty and useless, drops off. The males are provided with two peculiar organs, placed at the inner edge of the ventral fins. Some have supposed that these are *intimately* connected with the generative process; others regard them as mere *holders*, by means of which the female is more closely embraced by the male.

Genus Squalus, Linn.; Shark. This forms the first great genus of our present order. The general form is elongated; the tail is thick, with the spinal column continued into the upper lobe; the pectoral fins are of considerable size; the spiracles are on the sides of the neck; and the eyes on each side of the head. The muzzle is supported by three cartilaginous projections, proceeding from the anterior part of the cranium; and we can easily observe in the skeleton the rudimentary jaws. The scapula is suspended in the flesh behind the gills. Some of the sharks are oviparous, while others are viviparous. Distinct but small branchial rays; there are rudiments of ribs along the spine; and that column is divided into regular vertebræ.

The original genus is numerous, and may be divided as follows.

Genus Scyllium, Cuv. This division is characterised by a short, obtuse muzzle, by nostrils near the mouth, continued in grooves which reach to the edge of the lip, and more or less closed by one or two cuticular lobules. Their teeth have a central point and two lateral prongs. They have spiracles, partly over the pectoral fins. Their dorsal fins are placed far back, the anterior not being before the ventrals. All have an anal fin; and, in some species, its position corresponds to the interval between the two dorsals; the tail is elongated, truncated, not forked.

The most common on our coasts are the following species.

Sq. canicula, L.; greater spotted dog-fish, P. This common and prolific species is very numerous on the northern and western coasts of Britain. The colour of the male is dusky, with numerous distinct small, blackish, spots: the female, of which some naturalists have made another species, is larger than the male, of a more red hue, variegated with deep-brown spots disposed in an ocellated pattern on the sides. The ventral fins of this species have the edge cut obliquely.

Sq. catulus, et Sq. stellaris, are also the male and female of another species not uncommon on our coasts. This species differs from the last in size. The spots on its surface are fuller and broader; the ventral fins are more square at the edge.

To this sub-genus belong several other *Squali*, natives of foreign seas. They are distinguished by the position of the anal fin, which is placed behind the second dorsal; the spiracles are remarkably small; the fifth branchial aperture is often concealed in the fourth, and the lobes of the nostrils are usually prolonged into cirrhi.

Among the species are *Sq. pendulatus; Sq. Isabella*, Shaw; *Sq. cirrhatus*, Linn.; *Sq. lobatus;* and *Sq. tigrinus*, Lacép., or *Squalus fasciatus* of Bloch.

This last is one of the most beautiful of the order, and has been observed of the length of fourteen or fifteen feet, with a large and blunt head, and tapering body. (See Plate CCCVII. fig. 4.) A few years ago one of them was observed for several hours to follow a Liverpool East Indiaman off Madagascar. It was elegantly transversely banded with alternate whitish and dark brown or blackish fasciæ; and was further variegated by ocellated spots or rings on various parts of its body, which seemed to be about fourteen feet long. Its head appeared to be four and a half feet across; but the thickest part of its body did not seem more than two feet in diameter. It was accompanied by several *pilot-fish*, which often swam before, and returned towards it. Several attempts were made to catch it with large baits of fresh meat, but it never ventured to seize one of them. The lower jaw was distinctly visible whenever it opened its mouth, into which the accompanying fishes seemed to the spectators to enter and to leave at pleasure.

Genus Squalus properly so called, Cuv. This group comprehends all those species with a pointed muzzle, under which the nostrils are placed; but the latter parts are not terminated by a groove, nor are they furnished with lobules. The tail has more or less of a forked shape. We may farther subdivide this genus in accordance with the presence or absence of apertures behind the eyes, and of an anal fin.

Without Air-Holes, with Anal Fin.

Carcharias, Cuv. This well-known and numerous group have extremely sharp-pointed teeth, often serrated on their edges. Of these, their jaws are armed with several rows, which they have the power of elevating or depressing, and can use with remarkable effect, from the strength of the muscles moving the lower jaw. The first dorsal fin is considerably before the ventrals, and the second is almost opposite to the anal. The posterior branchial apertures are over the pectoral fins.

The best-known species is *Sq. carcharias*, or white shark, the dread of seamen in hot climates, and not unfrequently seen on our own coasts. It is a very large fish, growing, it is said, to more than thirty feet, and often observed to measure from fifteen to twenty-five feet. The teeth are, in full-grown animals, in six rows; those in the upper jaw are nearly isosceles triangles, with sharp, dentated edges; those in the lower jaw have a narrow lancet-shaped point on a broader basis, with smooth-cutting edges. From the position of the mouth in this species, the animal turns on its side on seizing its prey. Its voracity is well known, and it has been seen to leap out of the water in its eagerness to snatch a suspended morsel. The jaws are so powerful as to bite at once through the body of a man. The gullet is very large, and the intestine short. One killed near Marseilles is alleged to have had the entire body of a man, and several fish, in its stomach; and one captured off the island of St Margaretta is even said to have contained the whole body of a horse. This one had the enormous weight of 1500 pounds.

The sailors believe that the pilot-fish, which is so constant an attendant on this species, directs him to his prey; and, by touching his head, warns him against a baited hook. Certain it is, that the pilot-fish have been repeatedly seen clinging to a shark while he was hoisting on deck, and appeared as if distressed on separation from their formidable comrade, who has never been known, in his utmost voracity, to attack his friendly guides. What the instinct is that produces this attachment is unknown; but probably it depends on the pilot (*Naucrates ductor*) obtaining its subsistence from the remains of the shark's prey, as the jackal does from that of the lion.[1]

Little of the age or development of this species is ascertained. The female has been known to contain many ova; but only three or four are perfected at a time, and impregnation may take place long before the full growth of the animal. A shark ten feet long has been found to contain forty ova, three or four of which were near maturity.

Sq. vulpes, the thrasher, so called from the inordinate length of his tail, which is almost half the length of the animal. It is the upper lobe which is thus elongated; and as it has the fin along its under side, it gives the organ some resemblance to a fox's tail. It grows, even in our own seas, to a large size. Pennant measured one thirteen feet, of which the tail was more than six feet. The body is round, the nose short but pointed; the teeth are small, but sharp.

It is this species which is said to attack various Cetacea, which it harasses by dealing them violent strokes with its tail, when they rise to the surface for the purpose of breathing.

Sq. glaucus, the blue shark, is a very bold and voracious fish, not unfrequent on our coasts during the herring season. It grows to ten, or even fourteen feet in length; is of a slaty blue above, and smoother than the rest of the genus. Head large, muzzle very pointed; mouth large; teeth almost triangular, long, sharply pointed; the upper curvilinear, bent outwards; the lower straighter, and all dentated.

The nostrils are long and transverse. Artedi and others have noticed a triangular fossule, with its apex downward, on the lower part of the back.

To this subdivision we must refer the following species: *Sq. ustus*, Dum.; *S. ocellatus; Sq. ciliaris;* and several Indian species, described by Russel.

Lamna, Cuv. This subdivision is distinguished from the last by having all the spiracles *before* the pectoral fins, and by having a projecting pyramidal snout.

Squalus cornubicus, portbeagle shark, is well known in the Mediterranean and British seas, and is formidable on account of its teeth and size. One caught in 1834, on the coast of Caithness, now in the College Museum of Edinburgh, measures eight and a half feet, and is in girth four feet eight inches. Its teeth are upwards of an inch in length, extremely sharp, but not serrated. There are three rows of teeth, of an elongated form, slightly bent outward, and extremely sharp. The nostrils are under the snout, two and a half inches from the eye.[2] The circumference of the mouth round both jaws is about three feet. This animal is confounded with the white shark, both by seamen and naturalists; but it differs in the form of its teeth, as well as in the other circumstances noticed in the character.

The colour of this species is deep bluish-black, and the skin is smoother than that of most of its congeners.

Sq. monensis, Beaumaris shark, first described by Pennant, was by some considered as a sexual difference only of the last; but this is a mistake. Though similar in many respects, they are quite distinct, as the following characters, taken from a fine specimen caught in Orkney in 1833, will show. The colour of the upper parts a pale leaden gray, the lower parts yellowish white. Skin above covered with very minute granular roughnesses, but less prominent than in the *Squalus catulus* and *Sq.*

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[1] We have already discussed the point above alluded to, at greater length, in a preceding portion of the present treatise. See p. 185.

[2] The following are the more detailed measurements of the specimen above mentioned:—

	Feet.	Inches.		Feet.	Inches.
Extreme length along curvature of back	8	3	First dorsal, high, along its edge	1	1
Girth at abdomen	4	8	——— perpendicularly	0	10
—— at spiracles	4	0	——— broad	0	9·5
Width of mouth round upper lip	1	9	Second dorsal, high	0	1·8
——— round lower lip	1	4	——— broad	0	1·5
Length of teeth in upper jaw	0	1·5	Pectorals along edge	1	5
——— in lower jaw	0	1·2	——— broad	0	9
Length of muzzle from eye	0	7·5	Caudal, upper lobe	1	10·5
——— from upper lip	0	4·5	——— lower lobe	1	3
Eye in diameter about	0	1	——— spread	2	0
Nostrils from eye	0	2·5	Ventral at outer edge	0	4
Length of spiracles	0	9	From pectoral to ventral	2	4
From snout to first dorsal	3	5·5	Keel near tail	0	9·5
From first to second dorsal	2	6	Anal fin, broad	0	1·5
From second dorsal to caudal	0	0			

canicula. Form of the head obtusely conical, muzzle blunt. The teeth were in three rows, two of which were recumbent, rather than with sharp points and cutting edges, and two small processes at the bases of those of the lower jaw. Numerous nasal pores were perceived on the snout, six of which on each side admitted a slender probe to the depth of three inches; but there were no temporal apertures. A deep sulcus, eight inches long, extended from the ventrals to within two inches of the anal fin. This specimen was a male, with two *holders*, each one foot two inches long, by one and a half in diameter. As this species is rare, we shall give its dimensions.

	Feet.	Inches.
Extreme length along curvature of back	7	8
Girth where thickest	4	8
Upper lip from muzzle	0	5
Mouth along curvature of upper lip	1	1
Eye round, in diameter	0	1·7
First dorsal, placed a little behind pectoral	1	1
Second dorsal, very small, over anal	0	2
Anal fin	0	2·5
Pectorals along their curved edge	1	6
Tail lunated, extent across tips	3	0
Upper lobe of ditto	1	9
Lower ditto of ditto	1	3
Distance between ventral and anal	0	10

Both this and the last species have, just above the tail, lateral projections, that in the centre rise into a blunt edge one inch from the general surface in the middle, and decline gradually into the general surface at both ends. These are about eight or nine inches long.

With Air-Holes and Anal Fin.

Galeus, or Tope. These chiefly differ from the true *Squali* in having the temporal apertures. One species is found on our coasts, and is not uncommon in the Firth of Clyde. It seldom exceeds, with us, five or six feet; and there is reason to suspect that the accounts sometimes given of its enormous size arise from confounding it with other sharks. Its skin has a very rank, offensive smell; its colour above is light cinereous, below white; nose long, flattened, and sharp at the point. The muzzle seems translucent toward the end; the nostrils are near the mouth; the first dorsal is placed towards the middle of the back, and is rather large; the second is near the tail; the tail is finned beneath, and ends in a sharp angle above.

Mustelus, Hound. This subdivision combines the characters of *Carcharias* and *Galeus*, but it has the temporal apertures and small rounded teeth. The species are of moderate size: Cuvier thinks that Linnæus has confounded two distinct species in his *Sq. mustelus.*

Notidanus, Dry-back. This subdivision is distinguished from *Galeus*, to which it has much resemblance, by the want of the first dorsal fin.

Sq. cinereus has a pointed muzzle, seven large branchial apertures, with a smooth skin compared to most of the family of sharks: the teeth are compressed and sharp; the dorsal is in the middle of the back. Length about three feet.

Sq. griseus. Colour, ash colour above, white below; six wide branchial apertures; teeth large, triangular above, serrated below; snout depressed and rounded; anal fin half way between the ventral and the tail. These two are natives of the Mediterranean. Another species of this subdivision is found in the Indian seas.

Selache, Basking Shark. Contains as yet only a single species, which unites to the general form of *Carcharias*, and to the air-holes of Galeus, large branchial apertures almost surrounding the neck. It is the gills of this species that have been erroneously described as a sort of whalebone. The mouth is provided with small teeth; the muzzle projects far beyond it. Nothing has ever been found in its stomach except the remains of Fuci or Algæ, in the numerous instances in which it has been captured in various parts of Scotland. They grow to thirty or thirty-six feet or more, and are fishes of great strength, but are harmless, indolent, and not very sensible to slight wounds. They often lie on the surface of the water, with their large dorsal fin exposed, and permit the approach of boats until the harpoon can be securely fixed in their bodies. They sometimes appear in shoals, but more commonly in pairs; and enter the bays on the western and northern shores of Britain in the months of June and July, but retire from the land on the approach of cold weather. The liver of a full-grown fish has been known to afford eight barrels of fine oil; and on this account the basking shark is considered as a profitable capture.

This is the species to which Sir E. Home erroneously referred the supposed sea-snake, driven on shore in Orkney in 1808; but the enormous length of that animal, the smallness of the vertebræ of the neck, and of its whole head, still preserved in the Museum of the University of Edinburgh, prove that idea to be inconsistent with the fact, and show that singular animal to have been some great species of cartilaginous fish as yet unknown to naturalists,—a species in which we are to look for the prototype of the famous sea-serpent of the Northern Skalds, and the wild legends of the Sagas.

Cestracion, Cuv. This sub-genus has the temporal apertures, the anal fin, and rounded teeth of *S. mustelus;* but the mouth is terminal, or at the extremity of the pointed muzzle; the middle teeth are small and pointed, those at the angles of the jaw are very broad, and rhomboidal. The only known species is a native of the Australian seas, the *Sq. Philippi*, which has an elongated lobe on each side of the head.

Species without Anal Fin, but with Air-Holes.

Spinax, Cuv.; Dog-fish. The *Sq. acanthias*, one of our most common sharks, is the type of this sub-genus. It has all the usual general characters of the *Squali*, but is without an anal fin; it possesses the temporal apertures, and is distinguished by a strong spine placed just before each dorsal. The muzzle of our *piked dog-fish* is long; the teeth in two rows, small, and cutting, bending from about the middle of the jaw toward the corners of the mouth. The tail is unequal; the upper lobe much the longest, but the lower lobe is *finned* for a considerable space beneath. The colour is of an ash-gray, dashed with brown above and white below: when young, the sides are mottled with whitish spots.

Several foreign species, especially those described by Rafinesque, appear mere varieties of our *Squalus spinax;* indeed this author has multiplied species on very slender authority.

Centrina, Cuv. So called from their strong dorsal spines. This subdivision has all the characters of *Spinax*, as far as the spines, want of the anal fin, and possession of temporal apertures; but the body is less elongated, the last dorsal is placed over the ventral, and the tail is short. The best known is the

Sq. centrina, Linn. A species uncommon in our seas, but occurring on various coasts of Europe. (Plate CCCVII. fig. 6.) The mouth is far beneath the snout; the nose is blunt; the head small; in the upper jaw are three rows of teeth, and one only in the lower, all of which are slender and pointed. The dorsal fins are large; the spine in the anterior pointing forward, that in the posterior is directed backwards; both project through the epidermis of the fins.

The *Squalus squamosus* belongs to this division. It is

Chondropterygii. Selachii.

allied to *Sq. centrina*, but has conspicuous, ovate, hard, carinated scales.

The skin, like that of most other sharks, is rough, with numerous sharp granular eminences.

Scymnus, Cuv. This subdivision has all the characteristics of *Centrina*, except the dorsal spines.

The European species is the *Sq. Americanus* of Broussonet and Shaw. It occurs on the coasts of France, off Cape Breton, which has been mistaken for the transatlantic Cape Breton. It appears to be identical with Risso's *Sq. Nicensis.*

The formidable animal described by O. Fabricius, in his *Fauna Groenlandica*, as *Sq. carcharias*, is now, from the descriptions of Scoresby and others, to be referred to this sub-genus. It is Scoresby's *Sq. borealis.* It wants the anal fin, but has the temporal orifices. It grows to the length of twelve or fourteen feet, and is six or eight in circumference. Scoresby mentions the singular appendages which he invariably found attached to the cornea of this animal. Some have supposed them to be parasitic animals. If so, it is singular that they should be so uniformly in the same position, and of the same size, about one or two inches long, and cleft at their fore extremity into two parts. This shark is peculiarly attracted by a dead whale, out of which it scoops at once masses of blubber as large as a man's head. The sailors believe this species to be blind, from its returning to feed on its favourite morsel, even after having a flensing knife run through its body; but this only shows its fondness for whale blubber,—to which circumstance we may also attribute the comparative safety of Greenland sailors who have fallen into the water when flensing the whale. But, if we may credit Fabricius, when this delectable food is not present, he will attack the slender bark of the Greenlanders.

To this division belong also the *Sq. spinosus* and *Labordii.*

Genus Zygæna, Cuv. This genus, which has the general form of body and fins of *Carcharias*, is distinguished by the extraordinary form of its head, that has no analogy in nature, except in some of the insect tribe. It is flattened horizontally, truncated in front, and extended laterally into two arms, at the extremity of which are the eyes, giving to the animal the form of a hammer. The mouth is below the centre of this singular head, and the nostrils at its anterior edges on each side. The most common in Europe is the *Sq. zygæna*, or hammer-headed shark, which often attains the length of sixteen or seventeen feet, and is formidable on account of its voracity and strength. It is found also around the West Indies, and in the Indian Ocean, especially at Taheite, where the natives are said, from their dexterity in swimming, to hold it in little dread. It is a very prolific animal. Two kindred species are known: the *Sq. Blochii*, Cuv., which differs in having the nostrils nearer the middle of the head, and its two dorsals much nearer the tail; and *Sq. tiburo*, or heart-headed shark, a much rarer species, which we have received from the coast of Guyana. We here figure *Zygæna Lewinii*, a species captured off the south coast of New Holland. Plate CCCVII. fig. 5.

Genus Squatina, Dumer.; Angel-fish. Has the temporal apertures without the anal fin; but its mouth is terminal, and its eyes are both placed on its dorsal surface, in which it differs from all the sharks. The head and body are flattened; the pectoral fins are extremely broad, and project forward to the sides of the head, but are separated from it and the neck by a fissure, in which the branchial apertures are placed; the two dorsals are behind the ventrals, and the tail is equally finned above and below the spinal column.

The best-known species is the *Sq. squatina*, Linn., or angel-shark, which grows to eight or ten feet. It is a bold and voracious fish; when captured, it bites with great fury; it preys much on flat fish; it has tentacula on its upper lip; its eyes, placed obliquely, give it a sinister look. The English name has been given ironically to this hideous creature, which is by seamen generally termed *devil-fish.*

The teeth are slender, sharp, and dilated at their base; the dorsal fins very small, the pectorals very broad, the ventral large, and enclosing the male organs. The upper lobe of the tail longer than the lower. It is very prolific, fourteen young being sometimes found in its belly; twelve frequently.

To this genus we must also refer the *Sq. aculeatus* of the Mediterranean.

Genus Pristis, Lath.; Saw-fish. This last genus has the general form of the *Squali*, but is more flattened in front, and has the branchial apertures beneath, like the *Rays.* The most peculiar character, however, consists in the great depression and extension of the snout, which has on each side a row of strong teeth or spines, which are trenchant on the fore-side, and mucronated. These spines are not, however, their true teeth. These are lodged in the mouth, and are very small and rounded. But, with their formidable beak, they are said successfully to attack the larger Cetacea. In the fœtal Pristis the rudiments of these osseous spines are mere tubercles, and the snout is folded up over the head of the embryon. These spines are not, like the teeth of cartilaginous fishes, attached by ligaments to the bones, but are firmly implanted in the bone of the snout.

The best-known species is the *Sq. pristis* of Linn. or *Pristis antiquorum.* It grows to a great size. We have measured snouts more than ten inches in diameter, and four feet seven inches in length, with sixteen or eighteen spines on each side, some of which projected three inches. The animal attains the length of sixteen or eighteen feet. There are other species chiefly distinguished by the number and form of these spines: as *Pristis cuspidatus,—Pr. pectinatus*, with numerous slender teeth,—*Pr. microdon,* —*P. cirratus*, with alternate long and short teeth,—and *Pr. semi-sagittatus*, a small Indian species, in which the spines are deeply denticulated on the posterior edge.

Genus Raia (or Ray) of Linnæus. This great genus of the Selachii is very numerous, and the species often grow to a vast size. They are readily recognised by their flattened body, like the *Pleuronectes*, forming a horizontal disk, very broad in proportion to its thickness, in consequence of the body graduating into the enormous pectorals of the animal, which unite in front with the snout, and extend on both sides of the abdomen to the base of the ventral fins. See skeleton of the thorn-back (*R. clavata*), Plate CCCVII. fig. 9. The scapula of these vast pectorals are articulated with the spine just behind the branchial apertures. These apertures, the nostrils, and mouth, are on the ventral surface of the fish; the temporal orifices, and the eyes, are on the dorsal surface. The dorsal fins are usually placed on the tail. These animals are oviparous. Their eggs are coriaceous, square, with long angles. The subdivisions of Cuvier are the following.

Genus Rhinobatus, Sch. Distinguished by the length of the snout; connects the sharks and rays. They have a thick and fleshy tail, like *Squali*, with two dorsal and two caudal fins. Their snout and pectorals form a sharp rhomboid. Their teeth are placed in a quincunx arrangement. In some the first dorsal is placed over the ventral fins, in others it is placed farther back. The best known is the Mediterranean *Raia rhinobatus*, which is found four feet in length. The others are, *R. Thouiniana* (Plate CCCVII. fig. 7), supposed by Cuvier a variety of that just named, but it has such difference of form as to entitle it to be considered a distinct species; *R. djiddensis*, Forsk.; one described by Russel, *R. suttivara;* and one from Brazil, *R. electricus*, Marc, which, as its specific name implies, has been said to possess some of the properties of the *Torpedo.*

Genus Rhina, Sch. This subdivision has a short, rounded muzzle; in other respects it is like the last named. The species is *R. ancylostomus* of Bloch.

Genus Torpedo, Dum. This subdivision is short, and rather fleshy. The body appears a nearly circular disk, the anterior edge being composed of two projections of the muzzle, which stretch sidewise, and unite with the pectorals. The space between these last and the head is entirely filled with the very extraordinary electric apparatus first accurately described by John Hunter. It consists of irregular columns, varying from one and a half inch to one fourth of an inch in length by 0·2 broad. They are irregular hexagons or pentagons, reaching from surface to surface of the fish, and forming (in that dissected by Hunter) an electric organ five inches long, varying in breadth from three to about one and a half inches. Their number on both sides is about 940 in a small fish; but in a large one there were 2364. Their coats are thin and transparent; they are horizontally divided by thin partitions, so numerous that one inch of these columns contained 150 dissepiments filled with fluid. This curious apparatus is supplied with numerous nerves from the eighth pair. The columns are firmly united by cellular substance. When the skin covering this apparatus is touched, the person receives a violent shock at each contact; and it is probable that in this way the species stuns its prey. The animal can give the shock at pleasure; but if often reiterated, the shocks are weakened, until the nervous energy of the fish is recruited by rest. This animal electricity is conducted and intercepted by the same substances that conduct and intercept ordinary artificial electricity. We here figure *T. Bancroftii.* Plate CCCVII. fig. 8.

Several species occur in Europe, which Linnæus confounded together under the title of *Raia torpedo.* We have *Torpedo naske*, distinguished by having no fleshy dentations at the edges of its temporal apertures; its dorsal spots vary from one to five: *Torp. Galvanii* has seven dentations round its air-holes, and is of an uniform brown, sometimes marbled or spotted with darker tints: *Torp. marmorata* is another Mediterranean species, described by Risso. We know several foreign species, such as *Torp. temeree* and *Torp. nalatemeree* of Russel, *Torp. timlei?* of Bloch.

Genus Raia, *properly so called.* Has a rhomboidal body united to a slender tail, which has near its extremity two small dorsals, with, in some instances, a vestige of a caudal fin. The teeth are small, and disposed in a quincunx arrangement on the jaws. Several species inhabit the European seas, some of which are yet indifferently distinguished by naturalists. As articles of diet, some of them are frequently used; and though seldom seen at the tables of the rich, they are by no means despicable food, especially their pectorals.

Raia clavata, or thornback, is a common species, distinguished by the roughness of its back, and the strong osseous oval plates, each furnished with a curved prickle, that are irregularly scattered on both its surfaces. These plates are variable in number, and therefore do not afford any diagnostic character.

Raia rubus, rough ray. There is much confusion among Ichthyologists respecting this and the next species. Cuvier seems to think that the *Batis* of Pennant and *Rubus* of Lacépède are the same; but *Rubus* of Pennant and Willughby is certainly different from the skate, and distinguished from the last by its less pointed nose and the greater length of the tail, and is more thickly studded with small spines, not only on the back, but on the fins and belly, which are equally rough with the back. There are three rows of large spines down the tail, the surface of which is irregularly beset with small prickles. It is to this species that we confine the name of *R. rubus.* It is less common than *R. batis*, and is a much smaller fish. Found among the Hebrides.

R. batis, the skate. One of the thinnest and broadest of the tribe; but sometimes growing to an immense size, and weighing 200 pounds. The nose, though not very long, is pointed. Sometimes the surface of the back is marbled with dusky and white. Along the tail is one row of spines; a few are irregularly dispersed on the sides of the tail, and the fins of the males have many small spines.

The spring is their season of love; and when coupling, both may be drawn into the boat, though one only has taken the bait. The male *holders* appear to be true organs of penetration, as we have been assured by fishermen. The eggs have the form of coriaceous parallelograms, and are vulgarly with us termed *purses*, which the females begin to cast in May, and continue to perfect and cast till September. This species is often eaten, as well as the thornback, both in the greatest perfection in spring.

R. oxyrinchus, the sharp-nosed ray. We do not agree with Cuvier in confounding this with *R. batis.* The form of the nose is much longer and narrower; the body much smoother than any species we have mentioned, though there are triple rows of small spines along the tail. A single row of small spines runs down its back, and a few are scattered about the eyes. The teeth too, in this species, differ from those of the skate, being bent inward, and less granular. It is not inferior in size to the skate. Indeed specimens are said to have been seen of the weight of 500 pounds.

Some species of this division have a sort of membranous expansion, like a fin elevated in the middle of the back. This has been seen also in rays in other respects resembling the skate; but it is particularly conspicuous in *R. Cuvieri.* To this division likewise belong *R. undulata*, Lacép., *R. fullonica*, *R. marginata*, *R. miraletus*, Rondelet, *R. picta*, *R. alba*, and others.

Genus Trygon, Adans. Is characterised by having the tail armed with a spine, finely serrated on both sides; and by the teeth, which are slender, and crowded in a quincunx. Form of the disk obtuse; some have the tail fleshy, but in many it is very slender, and almost destitute of the rudiment of a fin. Most of them have smooth bodies; their caudal spine long—a powerful weapon of offence and of defence, which inflicts severe and dangerous wounds.

R. pastinacea, Linn.; sting ray. Is found on the European coasts. Some have a few prickles on the back; it is tuberculated in others. In some species the lower part of the tail has a broad membrane,—others have a short tail terminated by a fin. The principal species are, *P. tuberculata; P. Wolga Tenkée*, Russ.; *P. sephen*, Forsk.; *P. Gesneri*, Cuv.; *P. lymna*, *P. Jamaicensis*, Cuv.; *P. cruciata*, Lacép.; *P. kunsua*, Russ.

Genus Anacanthus, Ehrenb. Has a general resemblance to *Pastinaca*, but is destitute of the spine and anal fin. This sub-genus is formed from the description received of the large *shagreen ray* of the Red Sea, in which the grains are stellular.

R. orbicularis, Bl. belongs to this division.

Genus Myliobatis, Dumer. This sub-genus has the head projecting beyond the pectorals altogether; and these fins have a greater proportional breadth than in the other rays, which gives these animals no small resemblance to a bird with its wings extended; but their name is derived from the millstone-like form of their broad flat teeth, planted on their jaws like the stones of a pavement: their tail, long, slender, and tapering to a point, is armed, as in *Pastinaca*, with a strong spine, toothed on both sides, and is furnished, just above the spine, with a small dorsal fin. In some instances there are two or more such spines.

Raia aquila, or eagle ray, grows to an immense size: it has a projecting parabolic snout: the plates or teeth in the middle of the jaws are in a single row, much broader than long; but the lateral ones are hexagons in three ranges. The eyes are prominent, the tail very long and slender. It has been known to measure fifteen feet in length, and to weigh 300 lbs. It is said to swim with a slow sailing motion, and when captured vibrates its tail with great activity. It yields much fine oil. Inhabits the Mediterranean, the Atlantic, and Indian Oceans. To this division also we must refer the following species:

R. guttata, Shaw, Plate CCCVII. fig. 10, synonymous with the *Eel-Tenkee* of Russel; *R. fasciata*, Shaw; *Myl. bovina*, and *Myl. marginata*, Geoff.; which last has the snout cleft into two short lobes, and belongs to the sub-genus *Rhinoptera* of Kuhl.

Genus Cephaloptera, Dum. The last division of the rays is distinguished by the bifurcation of the appendages to the head, derived from the pectorals, which give the species the appearance of being horned. The head is truncated between these projections; the teeth are less strong than those of *Pastinaca*, and are finely crenulated on the edges; the tail, spine, and small dorsal fin, resemble those of *Myliobatis*.

The best known is the gigantic *Chephal. giorna* of the Mediterranean, the back of which is blackish, bordered with violet. (Plate CCCVII. fig. 11.) The animals which are mentioned by Shaw as *Raia manatia*, *R. fabroniana*, and *R. Banksiana*, are considered by Cuvier as doubtful species.[1] It is probable that the *R. diabolus* of Willughby, described by Duhamel, and said also to occur at the Azores, may be a distinct species, or perhaps the same as the *Eregoodoo-Tenkée* of Russel, which Cuvier is disposed to consider as a species well established. *Ch. massena* of Risso is a Mediterranean species, twelve feet long and twenty-seven in circumference. The female weighs 1250 lbs., the male about 800 lbs. Top of the horns black, the base bluish externally, and white on their inner sides. Of the pair described by Risso, the female was first taken; and the author adds, that the male continued constantly about the boat for three days, as if bewailing the fate of his companion, and was then found floating dead.

FAMILY II.—CYCLOSTOMI, OR SUCKERS.

The suckers, as far as their skeleton is concerned, are the most imperfect of all vertebrate animals. The bodies of all their vertebræ are traversed by a single tendinous cord, uniformly tapering from head to tail, which almost reduces the vertebræ to cartilaginous rings, scarcely distinct from one another, and not even cartilaginous through their whole circumference. The body is terminated abruptly in front by a fleshy circular or semicircular mouth, supported on a cartilaginous ring formed by the union of the palatal and maxillary bones. No ribs are distinguishable: there are no solid branchial arches; but the small branchial rays, scarcely recognisable in *Squalus* and *Raia*, are in them fully developed, and united together into a sort of lattice. The gills, instead of the pectinated form they have in almost all other fishes, exhibit the appearance of little sacs, from the union of each gill with that adjacent. The labyrinth is enclosed in the cranium, the nostrils have only a single aperture, in front of which is a cul-de-sac, mistaken by some authors for a temporal orifice. The intestine is straight and narrow, with a spiral valve.

Genus Petromyzon, Linn. This genus is distinguished by seven branchial apertures on each side; the skin above and below the tail is elevated in a rayless fin. The sub-genera are the following:

Genus Petromyzon, Dum. or Lamprey *properly so called.* Maxillary ring armed with strong teeth, within which are tubercles, with a hard enamel lining the lips. This ring is suspended by a piece answering to an inter-maxillary bone. The tongue is furnished with two longitudinal ranges of small teeth, and is capable of vigorous motion. The tongue acting like a piston in the circular mouth, is an essential part of the mechanism by which the fish is enabled to attach itself firmly to stones, or to fasten itself to the larger fishes, which it is thus enabled to suck and devour at its leisure. In respiration, the water is carried from the mouth to the gills by a canal under the gullet, and pierced with lateral apertures. The dorsal fin is farther forward than the anus, and a second unites with the tail. The European species are,

P. marinus, the greater lamprey, which grows to the length of more than three feet. (Plate CCCVII. fig. 12.) It is considered as a delicate food, and is caught as it ascends rivers in the end of winter and spring.[2] Colour yellowish, marbled with brown. First dorsal fin very distinct from the second. This fish is common in the Severn, and in the mouths of many European rivers. Its supposed *hermaphroditism* is mentioned by Sir Everard Home.[3]

P. fluviatilis, the lampern, or nine-eyed eel.[4] Length from twelve to eighteen inches; olive back, silvery below; first dorsal distinct from the second. Two thick teeth, separate, in the top of the maxillary ring. Ascends rivers from the sea; swarms in the Thames, Severn, and Dee. Vast quantities taken in England are sold to the Dutch for the turbot fishery. It abounds in the rivers on the southern side of

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[1] There is no doubt, however, that one or other of those names refers to an existing though obscurely known species, of enormous size. A specimen of the *Banksian ray* is said to have been found on the coast of Barbadoes, of such a vast weight that seven yoke of oxen were required to draw it. A figure of the *Ceph. manatia* was sent to Lacépède, the original of which was alleged to be nearly twenty feet long. "It seems that it is to this species we may refer what Barrère and other travellers have said of the enormous rays of the American and equinoctial seas, which spring above the surface of the water, and splash it to an immense distance on falling into it. Levaillant, in his second voyage to Africa, speaks of having seen one, the smallest of three, which swam round about the vessel, about twenty-five feet long and more than thirty wide; and Sonnini speaks of one which appeared to him larger and wider than the ship in which he was sailing." "Colonel Hamilton Smith once witnessed the destruction of a soldier by one of these Cephalopteri, off Trinidad. It was supposed that the soldier, being a good swimmer, was attempting to desert from the ship, which lay at anchor in the entrance of the Bocca del Toro. The circumstance occurred soon after daylight; and the man, being alarmed by the call of a sailor in the main cross-trees, endeavoured to return to the vessel; but the monster threw one of his fins over him, and carried him down. The colonel is positive as to this fish being a Cephalopterus." (Griffith's *Animal Kingdom*, vol. x. p. 653.)

[2] The death of Henry I. was attributed to a too plentiful meal of lampreys. They seem, however, to have continued in high esteem in spite of that "untoward event;"—at least we find Henry IV. granting protection to such ships as brought over lampreys for his *royal consort's* table; and his successor issued a warrant to William of Nantes, for supplying himself and his army with these fishes, wherever they might happen to march. (*Rymer*, ix. 544, as quoted by Pennant.)

[3] *Phil. Trans.* 1815, 266.

[4] "Whether," says Sir Thomas Brown, "Lampries have nine eyes, as is received, we durst refer it unto Polyphemus himself, who had but one to judge it; an error concerning eyes, occasioned by the error of eyes, deduced from the appearance of divers cavities or holes on either side, which some call eyes that carelessly behold them; and is not only refutable by experience, but also repugnant unto reason." (*Pseudodoxia Epidemica.*)

Conclusion. the Baltic. Both these animals are very tenacious of life, and will live many days out of water.

P. planeri. About ten inches long; greatly resembles the preceding; but the two dorsal fins are united. It is also an European river fish.

The other species described by Shaw appear to be but mere varieties of the above.

Genus Myxine, Linn. This genus is properly separated from the lampreys, to which, however, it has much resemblance. It is distinguished by having only two spiracles, and by wanting eyes. The species best known, *Myxine glutinosa*, Linn., or glutinous hag, was classed by Linnæus with the Vermes; but its real place is among chondropterygian fishes. The mouth is a membranous ring, with a single tooth on its superior part; while the strong dentations of the tongue are arranged in two rows on each side, so as to give to these animals the appearance of having lateral jaws, like insects or nereides; but the rest of their structure corresponds with *Petromyzon*, and their tongue in particular performs the office of a piston in exhausting the mouth, so as to enable them to adhere to other bodies, like the lamprey. The lips are furnished with eight cirrhi, and above is an aperture communicating with the mouth; the body is nearly cylindrical, and terminates in a fin which surrounds the tail. The intestine is simple, wide, and straight, as viewed externally; but it is plaited within: the liver has two lobes: the eggs grow to a considerable size. When taken and confined in a large glass jar, a single fish will pour so much mucus from its lateral pores as to give the water the appearance of jelly.

Three species are known, which Cuvier makes the types of a corresponding number of sub-genera, as follows:

1*st*, Heptatremus, Dumer. With seven branchial apertures, as in the lamprey. This animal is the *M. Dombeyi*, found on the coast of South America by Dombey. It has a rounded head; the teeth are sharp, and arranged in two rows, respectively of fourteen and twenty-two, and with one longer than the rest in the upper part of the mouth; tail rounded at the extremity, and terminated by a very shallow fin.

2*d*, Gastrobranchus, Bloch. The intervals of the branchial rays open into a common canal for each side, and these two canals terminate in two apertures under the heart of the animal, about one third of its length from the head.

The only known species is the European *Myxine glutinosa*, Linn. On the Yorkshire coast the fishermen occasionally find that it has entered the mouths of fish on the hooks of the long lines, and devoured the flesh, leaving only the skin and bones. They often catch it in the fish thus emptied, and term it the *sea-hag*. It grows to the length of six or eight inches.

3*d*, Ammocætes, Dumer. Is destitute of a real skeleton; body cylindrical, with numerous annular lines around it, that give it much the appearance of a worm. It lives in the mud of rivers. Mouth cirrhated, toothless, lobated below, and incapable of adhering *by suction* to other bodies; fins very shallow; tail sharp at the tip; no tracheal tube, as in the rest, but the gills receive water from the œsophagus. The only species is *P. branchialis*, Shaw, the *Pride* of Pennant, which grows to six or eight inches long, and is as thick as a goose-quill. It inhabits the rivers of Oxfordshire, and occurs in various parts of the European continent.

We have now brought our exposition of the modern system of Ichthyology to a close. The subjects of which it treats are of deep and sustaining interest, in a philosophical point of view, and of the highest and most immediate importance when considered in relation to the economical advantages derivable by the human race. We have endeavoured to combine with the precise and technical expression of the generic and other characters such miscellaneous information as could be collected from authentic sources, with a view to render the subject more palatable to the general reader;—and if any great deficiency in that department is observable, we hope it may in some measure be attributed to the nature of this branch of natural history, the objects of which inhabiting another element from ourselves, have thus their on-goings too often veiled from mortal sight by a "world of waters,"—which no eye can pierce but the eye of Him who called the light out of darkness, and who created the "heavens and the earth, the sea, and all that in them is."

We shall conclude with a brief allusion to a subject of the highest interest to the naturalist,—one to which we believe no reference has been made in the introductory portion of the present treatise, and which, we regret, our now exhausted space must prevent us from exhibiting at greater length,—we mean the *geographical distribution* of fishes. Our knowledge of the laws which regulate that distribution is meagre in the extreme; in other words, the facts concerning their true localities are few, and have never been properly generalised. From the immeasurable extent and continuous nature of the fluid which they inhabit, they are supplied by nature with greater facilities of dispersion than most other animals; and the greater equality of the temperature of water, compared with that of earth or air, admits in several instances of the same species inhabiting almost every latitude from pole to pole. Those races especially, which, travelling together in vast shoals, speedily consume the natural food which each particular spot affords, are obliged, like the pastoral tribes of old, or the woodland hunters of America, to remove from place to place in search of additional supplies; and thus the species acquires a more widely extended distribution. It is thus that the cod and herring are spread over the whole extent of the Northern Ocean, and in undiminished numbers, notwithstanding the war of extermination which man and other voracious animals appear to wage against them. Those species which lead a solitary, and, as it may be called, a stationary life, are frequently confined within very narrow limits. The Chætodons, for example, which delight in rocky coasts covered with madrepores, attach themselves to the torrid zone, which produces so abundantly those magnificent ornaments of the sea. But though thus confined to particular spots, from which the individuals of the species seldom wander, the species itself may be said to be repeated again in different regions, separated from each other by almost insurmountable obstacles. Thus many of what may be termed stationary species are found identically the same along the coasts of Brazil, in the Arabian Gulf, and over the multiplied shores of Polynesia. It has hence been concluded, that such species, incapable of colonizing themselves by leaving their accustomed shores, and hazarding a journey across unknown oceans, have either been created in more places than one, or have been enabled to transport themselves by means different from any of those that are now available in the ordinary course of nature.

If the natural means by which the more powerful species inhabiting the saline waters of the ocean have spread themselves from clime to clime, be to a certain extent within the reach of our comprehension, it is otherwise with those peculiar to rivers, and the waters of inland lakes. How these have contrived to migrate from one region to another, and to people with identical species the depth of far-removed and solitary waters, separated from each other by chains of lofty mountains, or wide extended wastes of desert sand, is a problem which, in the present state of our knowledge, we seek in vain to solve. It may indeed at times happen that spawn or ova are carried by water-fowl

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from one great central reservoir to another, and thus the rivers of half a continent may be put in possession of species unknown before;—but this supposition scarcely suffices to account for the general diffusion of certain species, and still less for the narrow restriction of others equally exposed to the chances of that aërial flight.[1] (T.[2])

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[1] Consult M. Gaimard's *Mémoire sur la Distribution Geographique des Poissons;* an Essay on Geography considered in relation to natural history, in the seventh volume of the *Diction. Classique d'Hist. Nat.;* and our *Illustrations of Zoology*, letter-press preceding plate xx.

[2] The author of the preceding treatise has to acknowledge his obligations to Sir William Jardine, Bart., for the use of his notes on the Salmonidæ,—to Professor Traill, for assistance in relation to the Apodal Malacopterygian, and Chondropterygian tribes,—and to Dr Allan Thomson, for his aid in drawing up the history of the Clupidæ, and of the Sub-brachian Malacopterygians.

ICHTHYOPHAGI, FISH-EATERS, a name given to those who lived wholly on fishes. The word is Greek, being compounded of ἰχθυς, *piscis*, fish, and φαγειν, *edere*, to eat. This name or term has been applied to different people.

The Ichthyophagi spoken of by Ptolemy are placed by Sanson in the provinces of Nanking and Xantong. Agatharcides calls all the inhabitants between Carmania and Gedrosia by the name of *Ichthyophagi*. From the accounts given us of the Ichthyophagi by Herodotus, Strabo, Solinus, Plutarch, and others, it appears indeed that they had cattle, but that they made no use of them, excepting to feed fish withal.

ICHTHYPERIA, a term in *Natural History*, applied to the bony palates and mouths of fishes, usually met with either fossil, in single pieces, or in fragments. They are of the same substance with the bufonitæ; and are of various figures, some being broad and short, others longer and slender, some gibbose, and others plainly arched. They are likewise of various sizes, from the tenth of an inch to two inches in length, and an inch in breadth.

ICKENILD STREET is that old Roman highway, so denominated from the Icenians, which extended from Yarmouth in Norfolk, the eastern part of the kingdom of the Iceni, to Barley in Hertfordshire, giving name in the way to several villages, as Ickworth, Icklingham, and Ickleton, in that kingdom. From Barley to Royston it divides the counties of Cambridge and Hertford; from Ickleford it runs by Tring, crosses Bucks and Oxfordshire, passes the Thames at Goring, and extends to the west part of England.

ICOLMKIL. See IONA.

ICONIUM, at present COGNI, formerly the capital of Lycaonia in Asia Minor. St Paul, proceeding to Iconium (Acts, xiii. 51, xiv. 1), in the year of Christ 45, there converted many Jews and Gentiles. It is believed, that in his first journey to this city he converted St Thecla, so celebrated in the writings of the ancient fathers. But some incredulous Jews excited the Gentiles to rise against Paul and Barnabas, and as the former were upon the point of offering violence to them, the apostles were obliged to fly for security to the neighbouring cities. St Paul undertook a second journey to Iconium in the year 51, but we know no particulars concerning his journey which relate especially to Iconium.

ICONOCLASTES, or ICONOCLASTÆ, breakers of images; a name given to all those who reject the use of images in religious matters. The word is Greek, formed from εικων, *imago*, image, and κλαστειν, *rumpere*, to break.

In this sense, not only the reformed, but some of the eastern churches, are called Iconoclastes, and esteemed heretics, as opposing the use of images in the worship of God and the saints, and breaking their figures and representations in churches.

The opposition to images began in Greece under the reign of Bardanes, who was created emperor of the Greeks soon after the commencement of the eighth century, when the worship of images became common. But the tumults thus occasioned were quelled by a revolution, which, in 713, deprived Bardanes of the imperial throne. The dispute, however, broke out with redoubled fury under Leo the Isaurian, in the year 726, who issued an edict abrogating, as some say, the worship of images, and ordering all images, except that of Christ's crucifixion, to be removed from the churches; but, according to others, this edict only prohibited the paying to them any kind of adoration. This edict occasioned a civil war, which ravaged part of Asia, and afterwards reached Italy. The civil commotions and insurrections in Italy were chiefly promoted by the Roman pontiffs, Gregory I. and II. Leo was excommunicated, and his subjects in the Italian provinces rising in arms, either massacred or banished all the emperor's deputies and officers. In consequence of these proceedings, Leo assembled at Constantinople in 730 a council, which degraded Germanus, the bishop of that city, who was a patron of images; he also ordered all the images to be publicly burned, and inflicted a variety of severe punishments upon such as were attached to idolatrous worship. Hence arose two factions; one of which adopted the adoration of images, and on that account were called *iconoduli* or *iconolatræ;* whilst the other maintained that such worship was unlawful, and that nothing was more worthy the zeal of Christians than to demolish and destroy those statues and pictures which were the occasions of this gross idolatry; and hence they were distinguished by the titles of *iconomachi* (from εικων, *image*, and μαχω, *I contend*) and *iconoclastæ*. The zeal of Gregory II. was not only imitated, but even surpassed, by his successor Gregory III. in consequence of which the Italian provinces were separated from the Grecian empire.

Constantine, surnamed *Copronymus* (from κοπρος, *stercus*, and ονομα, *name*, because he was said to have defiled the sacred font at his baptism), succeeded his father Leo in 741, and in 754 he convened a council at Constantinople, regarded by the Greeks as the seventh œcumenical council, which solemnly condemned the use of images in public worship. Leo IV. who was declared emperor in 775, pursued the same measures, and had recourse to the coercive influence of penal laws, in order to extirpate idolatry. Irene, the wife of Leo, poisoned her husband in 780; assumed the reins of empire during the minority of her son Constantine; and in 786 summoned a council at Nice in Bithynia, known by the name of the Second Nicene Council, which abrogated the laws and decrees against the new idolatry, restored the use of images and of the cross, and denounced severe punishments against those who maintained that God was the only object of religious adoration. In this contest, the Britons, Germans, and Gauls, were of opinion that images might be lawfully continued in churches, but they considered the worship of these as highly injurious and offensive to the Supreme Being. Charlemagne distinguished himself as a mediator in this controversy. He ordered four books concerning images to be composed, refuting the reasons urged by the Nicene bishops to justify the use of images; and these books he sent to Adrian the Roman pontiff in 790, in order to engage him to withdraw his approbation of the decrees of the last council of Nice. Adrian wrote an answer; and in 794, a council of three hundred bishops, assembled by Charlemagne at Francfort-on-the-Mayn, confirmed the opinion contained in the four books, and solemnly condemned the use of images. In the Greek church, after the banishment of Irene, the controversy about images broke out anew, and was carried on by the contending parties, with various and uncertain success, during the half of the ninth century. But the scene changed on the accession to the empire of Leo the Armenian, who in 814 assembled a council at Constantinople, which abolished the decrees of the Nicene council. His successor Michael, surnamed *Balbus*, disapproved of the worship of images, and his son Theophilus treated them with great severity; but the Empress Theodora, after his death, and during the minority of her son, assembled a council at Constantinople in 842, which reinstated the decrees of the second Nicene council. The council held at the same place under Photius, in 879, and reckoned by the Greeks the eighth general council, confirmed and renewed the Nicene decrees.

The Latins were generally of opinion, that images might be suffered as the means of aiding the memory of the faithful, and of calling to their remembrance the pious exploits and virtuous actions of the persons whom they represented; but they detested all thoughts of paying them the least marks of religious homage or adoration. The council assembled at Paris in 824, by Louis the Meek, resolved to allow the use of images in the churches, but severely prohibited rendering them religious homage. Nevertheless, towards the conclusion of this century, the Gallican clergy began to pay a kind of religious homage to the images of saints, and their example was followed by the Germans and other nations. However, the Iconoclastes still had their adherents amongst the Latins. The most eminent of these was Claudius, bishop of Turin, who, in 823, ordered all images, and even the cross, to be cast out of the churches, and committed to the flames; and he wrote a treatise, in which he declared against the use as well as against the worship of images. He condemned relics, pilgrimages to the Holy Land, and all voyages to the tombs of saints; and to his writings and labours it was owing that the city of Turin and the adjacent country was, for a long time after his death, much less infected with superstition than the other parts of Europe. The controversy concerning the sanctity of images was again revived by Leo, bishop of Chalcedon, in the eleventh century, on occasion of the Emperor Alexius converting the figures of silver which adorned the portals of the churches into money in order to supply the exigencies of the state. The bishop maintained that he had been guilty of sacrilege, and published a treatise in defence of his views. The emperor assembled at Constantinople a council, which determined that the images of Christ and of the saints were to be honoured only with a relative worship; and that invocation and worship were to be addressed to the saints only as the servants of Christ, and on account of their relation to him as their master. Leo, being dissatisfied with these decisions, was sent into banishment. In the western church, the worship of images was disapproved and opposed by several considerable parties, as the Petrobossians, Albigenses, Waldenses, and others, until at length this practice was entirely abolished in many parts of the Christian world by the Reformation.

ICONOGRAPHIA (derived from εικων, *image*, and γραφω, *I describe*), the description of images or ancient statues of marble and copper, also of busts and semi-busts, penates, paintings in fresco, mosaic works, and ancient pieces of miniature.

ICONOLATRÆ, or ICONOLATERS, or ICONODULI. See ICONOCLASTES.

ICOSAHEDRON, in *Geometry*, a regular solid, consisting of twenty triangular pyramids, the vertices of which meet in the centre of a sphere supposed to circumscribe it, and therefore have their height and bases equal; wherefore the solidity of one of these pyramids multiplied by twenty, the number of bases, gives the solid contents of the icosahedron.

ICOSANDRIA (from εικοσι, *twenty*, and ανηρ, *a man* or *husband*), the name of the twelfth class in Linnæus's sexual method, consisting of plants with hermaphrodite flowers, which are furnished with twenty or more stamina, that are inserted into the inner side of the calyx or petals. See BOTANY.

ICTINUS, a celebrated Greek architect, who lived about 430 B. C., built several magnificent temples, and amongst others that of Minerva at Athens.

IDA, in *Ancient Geography*, a mountain situated in the heart of Crete, being the highest in the island, round, and in compass about sixty stadia (Strabo); the nursing place of Jupiter, and where his tomb was visited in Varro's time. There was another *Ida*, a mountain of Mysia, or rather a chain of mountains, extending from Zeleia, on the south of the territory of Cyzicus, to Lectum, the utmost promontory of Troas. The abundance of its waters became the source of many rivers, and particularly of the Simois, Scamander, Æsopus, and Granicus. It was covered with green wood, and the elevation of its top opened an extensive view of the Hellespont, and the adjacent countries; for which reason it was, according to Homer, frequented by the gods during the Trojan war. The top was called *Gargara*, and celebrated by the poets for the judgment of Paris on the beauty of the three goddesses, Minerva, Juno, and Venus.

IDALIUM, in *Ancient Geography*, a promontory on the eastern side of Cyprus; now Capo di Griego. It was sacred to Venus, and hence the epithet *Idalia* given her by the poets.

IDEA, defined by some to be the reflex perception of objects, after the original impression has been made on the mind. In common language, it is used as synonymous with *notion* or *conception*.

IDENTITY denotes that by which a thing is itself, and not any thing else; in which sense *identity* differs from *similitude* as well as *diversity*.

IDES, in the ancient Roman calendar, were eight days in each month, the first of which fell on the 15th of March, May, July, and October; and the 13th day of the other months of the year. The origin of the word is contested. Some suppose it to have been formed from ἰδειν, *to see*, because the full moon was commonly seen on the days of the ides; others derive it from ειδος, *species*, *figure*, on account of the image of the full moon then visible; others from *idulium* or *ovis idulis*, a name given by the Etruscans to a victim offered on that day to Jupiter; and others again from the Etruscan word *iduo*, meaning to *divide*, because the ides divided the month into two nearly equal parts.

The ides came between the *kalends* and the *nones*, and were reckoned backwards. Thus they called the 14th day of March, May, July, and October, and the 12th of the other months, the *pridie idus*, or the day before the ides; the next preceding day they called the *tertia idus;* and so on, reckoning always backwards till they came to the *nones*. This method of reckoning time is still retained in the chancery of Rome, and in the calendar of the Breviary.

The ides of May were consecrated to Mercury; and the ides of March were ever esteemed unfortunate, after Cæsar's murder on that day. The time after the ides of June was reckoned fortunate for those who entered into matrimony; the ides of August were consecrated to Diana, and were observed as a feast-day by the slaves. On the ides of September, auguries were taken for appointing the magistrates, who formerly entered into their offices on the ides of May, and afterwards on those of March.

IDIOCY, a defect of understanding. Both idiocy and lunacy excuse from the guilt of crimes. For the rule of law as to lunatics, which may also be easily adapted to idiots, is, that *furiosus furore solum punitur.*. In criminal cases, therefore, idiots and lunatics are not chargeable for their own acts, if committed when under these incapacities; not even for treason itself. Also, if a man in his sound memory commits a capital offence, and before arraignment becomes mad, he ought not to be arraigned for it; because he is not able to plead to the charge with that advice and caution that he ought. And if, after he has pleaded, the prisoner becomes mad, he shall not be tried; for how can he make his defence? If, after he be tried and found guilty, he loses his senses before judgment, judgment shall not be pronounced; and if, after judgment, he becomes of unsound memory, execution shall be stayed; for peradventure, says the humanity of the English law, had the prisoner been of sound memory, he might have alleged something in stay of judgment or execution. But if there be any doubt whether the party be *compos* or not, this shall be tried by a jury; and if he be found *non compos*, a total idiocy, or absolute insanity, excuses from the guilt, and of course from the punishment, of any criminal action committed under such deprivation of the senses; but if a lunatic has lucid intervals of understanding, he shall answer for what he does in those intervals, as if he had no deficiency. It was the doctrine of the ancient English law, that persons deprived of their reason might be confined till they recovered their senses, without waiting for the forms of a commission or other special authority from the crown; but now a method is chalked out for imprisoning and sending them to their proper homes.

The matrimonial contract, likewise, cannot take place in a state of idiocy. It was formerly adjudged, that the issue of an idiot was legitimate, and his marriage valid. But since consent is absolutely requisite to matrimony, and neither idiots nor lunatics are capable of consenting to any thing, therefore the civil law judged much more sensibly when it made such deprivations of reason a previous impediment, though not a cause of divorce if they happened after marriage. Modern resolutions have adhered to the sense of the civil law, by determining that the marriage of a lunatic, not being in a lucid interval, was absolutely void. But as it might be difficult to prove the exact state of the party's mind at the actual celebration of the nuptials, the statute 15 Geo. II. c. 30, has provided, that the marriage of lunatics and persons under phrensies (if found lunatics under a commission, or committed to the care of trustees under any act of parliament), before they are declared of sound mind by the lord chancellor, or the majority of such trustees, shall be totally void.

Idiots and persons of unsound memory, as well as infants and persons under duress, are not totally disabled either to convey or purchase, but *sub modo* only; for their conveyances and purchases are voidable, but not actually void. The king, indeed, on behalf of an idiot, may avoid his grants or other acts. But it has been said, that a *non compos* himself, though he be afterwards brought to a right mind, shall not be permitted to allege his own insanity in order to avoid such grant; because no man shall be allowed to stultify himself, or plead his own disability. The maxim that a man shall not stultify himself, has in fact been handed down as settled law; though later opinions, feeling the inconvenience of the rule, have in many points endeavoured to restrain it. The next heir, or other person interested, may clearly, after the death of the idiot or *non compos*, take advantage of his incapacity, and avoid the grant; and so, too, if he purchases under this disability, and does not afterwards upon recovering his senses agree to the purchase, his heir may either waive or accept the estate at his option. In like manner, an infant may waive such purchase or conveyance when he comes to full age; or, if he does not then actually agree to it, his heir may waive it after him. By the statute 11 Geo. III. c. 20, the guardians or committees of a lunatic are empowered to renew in his right, under the directions of the Court of Chancery, any lease for lives or years, and apply the profits of such renewal for the benefit of such lunatic, his heirs, or executors.

In the law of Scotland, an idiot, or fatuous person, is one entirely deprived of the faculty of reason, having an uniform stupidity and inattention in his manner, and a childishness in his speech, which distinguish him from other men. This state is ascertained by the judgment of a jury, on a brieve directed to the judge-ordinary of the bounds within which the person resides, and containing two heads of inquest; one relating to the state of the person, and the other having for its object to ascertain who is the nearest male agnate of twenty-five years of age. The brieves for cognoscing furious persons are nearly similar, differing only in the description of the circumstances into which the jury are to inquire. As a state of idiocy disqualifies the person for entering into transactions, a proof, even after his death, that the granter of a deed was an idiot at the time of granting it will be sufficient for reducing that deed; and, according to Bankton, restitution on the ground of idiocy is competent to idiots against their curators within four years after their convalescence, in the same way as it is competent to minors.

IDIOM, amongst grammarians, properly signifies the peculiar genius of each language, but is often used in a sense synonymous with dialect. The word is Greek, ἰδιωμα, *propriety*, formed from ἰδιος, *proper, own*.

IDIOPATHY, in *Physic*, a disorder peculiar to a certain part of the body, and not arising from any preceding disease; in which sense it is opposed to sympathy. Thus, an epilepsy is idiopathic when it happens merely through some fault in the brain, and sympathetic when it is the consequence of some other disorder.

IDIOSYNCRASY, amongst physicians, denotes a peculiar temperament of body, by which it is rendered more liable to certain disorders than persons of a different constitution usually are.

IDIOT, or IDEOT, in our laws, denotes a natural fool, or a fool from his birth. See IDIOCY.

The word is originally Greek, ἰδιωτης, which primarily imports a private person, or one who leads a private life, without any share or concern in the government of affairs.

IDIOT is also used, by ancient writers, to signify a person ignorant or unlearned, and answers to *illiteratus*, or *imperitus*. In this sense, Victor tells us, in his *Chronicon*, that in the consulship of Messala, the Holy Gospels, by command of the Emperor Anastasius, were corrected and amended, as having been written by idiot evangelists: *Tanquam ab idiotis evangelistis composita.*

IDLENESS, a reluctance in people to be employed in any kind of work.

Idleness in any person whatsoever is a high offence against the public economy. In China it is a maxim, that if there be a man who does not work, or a woman that is idle, in the empire, somebody must suffer cold or hunger upon that account, the produce of the lands not being more than sufficient, with culture, to maintain the inhabitants; and therefore, though the idle person may shift off the want from himself, yet it must in the end fall somewhere. The court of Areopagus at Athens likewise punished idleness, and exerted a right of examining every citizen as to the manner in which he spent his time; the intention of this being, that the Athenians, knowing they were to give an account of their occupations, should follow only such as were laudable, and that there might be no room left for those who lived by unlawful arts. The civil law expelled all sturdy vagrants from the city; and, in the English law, all idle persons or vagabonds, whom our ancient statutes describe to be "such as wake on the night and sleep on the day, and haunt customable taverns and ale-houses, and routs about; and no man wot from whence they come, ne whether they go;" or such as are more particularly described by the statute 17 Geo. II. c. 5, and divided into three classes, namely, idle and disorderly persons, rogues and vagabonds, and incorrigible rogues; all these are offenders against the good order, and blemishes in the government, of any kingdom. They are therefore all punishable by the statute last mentioned; idle and disorderly persons with one month's imprisonment in the house of correction; rogues and vagabonds with whipping, and imprisonment not exceeding six months; and incorrigible rogues with the like discipline, and confinement not exceeding two years. Persons harbouring vagrants are liable to a fine of forty shillings, and to pay all expenses brought upon the parish thereby; in the same manner as, by our ancient laws, whoever harboured any stranger for more than two nights, was answerable to the public for any offence that might be committed by his inmate.

IDOL, in pagan mythology, an image or fancied representation of any of the heathen gods. This image, of whatsoever materials it might consist, was, by certain ceremonies called consecration, converted into a god; but whilst under the artificer's hand, it was only a mere statue. Three things were necessary to turn it into a god; proper ornaments, consecration, and oration. The ornaments were various, and wholly designed to blind the eyes of the ignorant and stupid multitude. Then followed the consecration and oration, which were performed with great solemnity amongst the Romans. See IMAGE.

IDOLATRY, or the worship of idols, may be distinguished into two sorts. By the first, men adore the works of God, the sun, the moon, the stars, angels, dæmons, men, and animals; by the second, men worship the work of their own hands, as statues, pictures, and the like: but to these may be added a third, that by which men have worshipped the true God under sensible figures and representations. This indeed may have been the case with respect to each of the above kinds of idolatry; thus the Israelites adored God under the figure of a calf.

The host of heaven were the first objects of idolatrous worship, on account of their beauty, their influence on the productions of the earth, and the regularity of their motions, particularly the sun and moon, which are considered as the most glorious and resplendent images of the Deity. But afterwards, when the sentiments of mankind became more corrupt, they began to form images, and to entertain the opinion, that by virtue of consecration, the gods were called down to inhabit or dwell in these statues. Hence Arnobius takes occasion to rally the pagans for guarding so carefully the statues of their gods, who, if they were really present in their images, might save their worshippers the trouble of securing them from thieves and robbers.

As to the adoration which the ancient pagans paid to the statues of their gods, it is certain, that the wiser and more sensible heathens considered them only as simple representations or figures designed to recal to their minds the memory of their gods. This was the opinion of Varro and Seneca; and the same sentiment is clearly expressed in Plato, who maintains that images are inanimate, and that all the honour paid to them has respect to the gods whom they represent. But as to the vulgar, they were stupid enough to believe the statues themselves to be gods, and to pay divine worship to stocks and stones.

IDOMENEUS, in fabulous history, succeeded his father Deucalion on the throne of Crete. He accompanied the Greeks to the Trojan war with a fleet of ninety ships. During this celebrated war he rendered himself famous by his valour, and slaughtered many of the enemy. At his return from the Trojan war, he made a vow to Neptune in a tempest, that if he escaped from the fury of the seas and storms, he would offer to the god whatever living creature first presented itself to his eye on the Cretan shore. This was no other than his own son, who came to congratulate his father upon his safe return. Idomeneus performed his promise to the god; and the inhumanity and rashness of this sacrifice rendered him so odious in the eyes of his subjects, that he left Crete, and having gone in quest of a settlement, landed in Italy, where he founded a city on the coast of Calabria, which he called Salentum. He died in extreme old age, after he had had the satisfaction of seeing his new kingdom flourish, and his subjects happy. According to the Greek scholiast of Lycophron (v. 1217), Idomeneus, during his absence in the Trojan war, intrusted the management of his kingdom to Leucos, to whom he promised his daughter Clisithere in marriage at his return. Leucos at first governed with moderation, but he was persuaded by Nauplius, king of Eubœa, to put to death Meda, the wife of his master, with her daughter Clisithere, and to seize the kingdom. By these violent measures he so strengthened himself on the throne of Crete, that Idomeneus at his return found it impossible to expel the usurper.

IDRIA, a city of the Austrian government of Laybach, in the circle of Adelsburg. It is on the river Idrizza, in a mountainous district, where are some of the richest mines of quicksilver in Europe, which have received greater activity from the neglected state of the similar mines at Almaden in Spain. The city contains 320 houses, with 3650 inhabitants, who are chiefly dependent on the mines for employment. Long. 15. 3. 45. E. Lat. 46. 0. 48. N.

IDSTEIN, a bailiwick of the principality of Nassau, in Germany. It extends over about 82,000 acres, and contains 13,500 inhabitants, of whom about 7000 are Catholics and 6000 Lutherans, with a few Menonites, and some Jews. It contains two cities and twenty-nine villages. The capital is a small city of the same name. It stands at the foot of a mountain, and is surrounded with walls. The inhabitants amount to 1860, employed in curing leather, and other trades. Near to it is the palace of Gassenbach, belonging to the sovereign; and around it his experimental farm, on which are large flocks of Merino sheep.

IDUMÆA. See Edom.

IDYLLION, in ancient poetry, properly signifies any poem of moderate extent, without considering the subject. But as the collection of the poems of Theocritus was called *Idyllia*, and the pastoral pieces being by far the best in that collection, the term *Idyllion* seems to be now appropriated to pastoral pieces.

IF, an island of France, in Provence, and the most eastern of the three before the harbour of Marseilles. It is well fortified, and its port is one of the best in the Mediterranean.

IFSHWAR, a town of Hindustan, in the Mahratta territories, in the province of Malwah, thirty miles south-west from Bopal. Long. 77. 8. E. Lat. 23. 24. N.

IGLAU, a circle of the Austrian province of Moravia, extending over 1110 square miles, comprehending thirty-five cities and towns, 469 villages and hamlets, 23,312 houses, and 146,189 inhabitants. The chief place is a city of the same name, situated on the river Iglawa. It is well built, and surrounded with walls; contains 1200 houses, with 10,986 inhabitants. It is a great manufacturing place, producing yearly from 40,000 to 50,000 pieces of cloth, besides much paper, leather, and other goods. Its situation, on the chief road through the province, furnishes a very considerable transit trade. Long. 15. 30. 55. E. Lat. 49. 23. 23. N.

IGLESIAS, a city in the island of Sardinia, in the province of Cagliari, the see of a bishop. It is finely situated amongst limestone hills, and abundantly watered by various springs; and the surrounding country is highly productive of corn, wine, and fruits. The population in 1826 amounted to 9545 persons.

IGNATIA, a genus of plants belonging to the pentandria class. See Botany, *Index*.

IGNATIUS Loyola, the founder of the order of Jesuits, was born at the castle of Loyola, in Biscay, in the year 1491. He became, first, page to Ferdinand V. king of Spain, and then an officer in the army. In the latter capacity he signalized himself by his valour, and was wounded in both legs at the siege of Pampeluna in 1521. To this circumstance the Jesuits owe their origin; for whilst he was under cure of his wound, a *Life of the Saints*, which was put into his hands, determined him to exchange the military for the ecclesiastical profession. His first devout exercise was to dedicate himself to the blessed virgin as her knight. He then went on a pilgrimage to the Holy Land; and upon his return to Europe he continued his theological studies in the universities of Spain, though he was then thirty-three years of age. After this he went to Paris, and in France laid the foundation of that new order, the institutes of which he presented to Pope Paul III. who made many objections to them, but at last, in 1540, confirmed the institution. The founder died in 1555, and left his disciples two famous books; first, Spiritual Exercises; second, Constitutions or Rules of the Order. But it must be remembered, that though these avowed institutes contain many privileges obnoxious to the welfare of society, the most objectionable are contained in the private rules, entitled *Monita Secreta*, which were not discovered till long afterwards; but most writers attribute these, and even the Constitutions, to Laynez, the second general of the order.

Ignatius, *St*, surnamed *Theophrastus*, one of the apostolical fathers of the church, was born in Syria, educated under the apostle and evangelist St John, and intimately acquainted with some other of the apostles, especially St Peter and St Paul. Being fully instructed in the doctrines of Christianity, he was ordained by St John, and confirmed, about the year 67, bishop of Antioch, by these two apostles, who first planted Christianity in that city, where the disciples also were first called *Christians*. Antioch was then not only the metropolis of Syria, but a city the most renowned of any in the East, and the ancient seat of the Roman emperors, as well as that of the viceroys and governors. In this important see he continued somewhat above forty years, and was both an honour and safeguard to the Christian religion, till the year 107, when Trajan the emperor, flushed with a victory which he had lately obtained over the Scythians and Dacians, about the ninth year of his reign, came to Antioch to make preparations for a war against the Parthians and Armenians. He entered the city with the pomp of a triumph; and as his first care usually was about the affairs of religion, he began presently to inquire into the state of the new faith Christianity had by this time made such progress, that the Romans became jealous and uneasy on account of its advancement. This prince, therefore, had already, in other parts of the empire, commenced a persecution against the Christians, which he now resolved to carry on here. However, as he was naturally of a mild disposition, though he ordered the laws to be put in force against them if convicted, yet he forbade them to be sought after.

In this state of affairs, Ignatius, thinking it more prudent to go himself than wait to be sent for, presented himself to the emperor; and it is said that there passed a long and particular discourse between them, in the course of which the emperor having expressed surprise how he dared to transgress the laws, the bishop took the opportunity to assert his own innocence, and to explain and vindicate his faith and freedom. The issue was, that he was imprisoned, and sentenced to be carried bound by soldiers to Rome, and there thrown as a prey to the wild beasts of the amphitheatre.

He was first conducted to Seleucia, a port of Syria, about sixteen miles distant, where Paul and Barnabas set sail for Cyprus. Having arrived at Smyrna, he paid a visit to Polycarp, bishop of that place, and was himself visited by the clergy of the surrounding country. He also wrote letters to several churches, as the Ephesians, Magnesians, Trallians, and even the Romans, for their instruction and establishment in the faith. He then set sail for Troas, a city of Phrygia, not far from the ruins of old Troy, where, upon his arrival, he was much refreshed with the news he received of the discontinuance of the persecution in Antioch. From Troas he sailed to Neapolis, a maritime town in Macedonia; thence to Philippi, a Roman colony, where the party were entertained with all imaginable kindness, and conducted forwards on their journey through Macedonia and Epirus, till they came to Epidamnium, a city of Dalmatia, where, having again taken shipping, they sailed through the Adriatic, arrived at Rhegium, a port-town in Italy, and directed their course thence through the Tyrrhenian Sea to Puteoli, whence Ignatius desired to proceed by land, ambitious to trace the same way by which St Paul had travelled to Rome. But this wish was not complied with; and, after a stay of twenty-four hours, a prosperous wind quickly carried them to the Roman port, the station of the navy, built near Ostia, at the mouth of the Tiber, about sixteen miles from Rome.

The Christians at Rome, daily expecting his arrival, came out to meet him, and received him with a mixture of joy and sorrow; but when some of them intimated that possibly the populace might be diverted from desiring his death, he expressed a pious indignation, entreating them to cast no obstacles in his way, nor do any thing that might tend to deprive him of that crown of martyrdom to which he ardently aspired. There are many such expressions as this in his epistle to the Romans, yet it does not appear that he rashly sought or provoked danger. Being conducted to Rome, he was presented to the prefect; and the emperor's letters concerning him were also delivered. The interval before his martyrdom was spent in prayers for the peace and prosperity of the church. That his punishment might be the more public, one of their solemn festivals, the time of the Saturnalia, and that part of it when they celebrated the Sigillaria, was fixed for his execution. Accordingly, on the 20th of December, he was brought out into the amphitheatre, and the lions being let loose, quickly despatched him, leaving nothing but a few of the hardest of his bones. These remains were gathered up by two deacons who had been the companions of his journey; and being transported to Antioch, were interred in the cemetery, without the gate which leads to Daphne.

St Ignatius stands at the head of those Anti-Nicene fathers who occasionally delivered their opinions in defence of the divinity of Christ, whom he calls the *Son of God, and his eternal word.* He is also reckoned the great champion of the doctrine of the episcopal order, as distinct from and superior to that of priest and deacon; and one, the most important, use of his writings respects the authenticity of the Holy Scriptures, which he frequently alludes to in the very same expressions which we find at this day. Archbishop Usher's edition of his works, printed in 1647, is thought the best; yet there is a more recent edition published at Amsterdam, where, besides the best notes, there are the dissertations of Usher and Pearson.

St Ignatius's Bean, the fruit of a plant. See Ignatia, Botany.

IGNIS Fatuus, a kind of light, supposed to be of an electrical nature, appearing frequently in mines, marshy places, and near stagnant waters. It was formerly thought to have something ominous in its nature, and to presage death and other misfortunes. There have been instances of people being decoyed by these lights into marshy places, where they perished; and hence the names of *Ignis fatuus, Will-with-a-wisp*, and *Jack-with-a-lanthorn*, as if this appearance were an evil spirit which took delight in doing mischief of that kind. The general opinion is, that this light is produced by the decomposition of animal or vegetable matters, or by the evolution of gases which spontaneously inflame in the atmosphere.

IGNITION properly signifies setting fire to any substance; but the sense is sometimes limited to that kind of burning which is not accompanied with flame, such as that of charcoal, cinders, metals, stones, and other solid substances. For the explanation of the phenomena of ignition, see Chemistry.

IGNOBILES, amongst the Romans, was the designation of those persons who had no right of using pictures and statues. See Jus Imaginis.

IGNOMINIA, a species of punishment amongst the Romans, by which the offender suffered public shame, either by virtue of the prætor's edict, or by order of the censor. This punishment, besides the disgrace, deprived the party of the privilege of bearing any offices, and of almost all the other rights of a Roman citizen.

IGNORAMUS, in *Law*, is a word properly used by the grand inquest impannelled in the inquisition of causes criminal and public, and written upon the bill, by which any crime is offered to their consideration, when they mislike the evidence, as defective, or too weak to make good the presentment; the effect of which word so written is, that all further inquiry for that fault is thereby stopped, and the party delivered without further answer. It resembles that custom of the ancient Romans, where the judges, when they absolved a person accused, wrote *A.* upon a little table provided for that purpose, meaning thereby *absolvimus;* but if they judged him guilty, they wrote *C.* for *condemnamus;* and if they found the cause difficult and doubtful, they wrote *N. L.* for *non liquet.*

IGNORANCE, the privation or absence of knowledge. The causes of ignorance, according to Locke, are chiefly these three; first, want of ideas; secondly, want of a discoverable connection between those ideas we have; and, thirdly, want of tracing and examining our ideas.

Ignorance, in a more particular sense, is used to denote want of learning.

Ignorance, or mistake, in *Law*, a defect of will, by which a person is excused from the guilt of a crime, when, intending to do a lawful act, he does that which is unlawful. For here the deed and the will acting separately, there is not that conjunction between them which is necessary to constitute a criminal act. But this must be an ignorance or mistake of fact, and not an error in point of law. For a mistake in point of law, which every person of discretion not only may, but is bound and presumed to know, is, in criminal cases, no sort of defence. *Ignorantia juris, quod quisque tenetur scire, neminem excusat*, is as well the maxim of our own law as it was of the Roman.

IGUALADA, a town of Spain, in the province of Catalonia, with 12,000 inhabitants. It is situated near the celebrated monastery of Montserrat, and has a strong castle, which was long occupied by the French during the Peninsular war. It has a very large manufactory of firearms. Lat. 41. 35. N.

IKERY, formerly a town of the south of India, and province of Mysore, of great note, and said by the natives, with their usual exaggeration, to have contained 100,000 inhabitants. It was for a long period the residence and capital of a dynasty of Hindu princes, whose coins are still in existence. It is now in ruins, not, however, from the devastation of war, or any other calamity, but merely from the removal of the court to Bednore. Long. 76. 7. E. Lat. 14. 6. N.

ILA, Ilay, or Islay, a large island belonging to Argyleshire, and the most southerly of those called the Hebrides. It lies in a westerly direction from the peninsula of Kintyre, distant from it about twelve miles, and is separated on the north from the island of Jura by a small channel. It is twenty-eight miles in length, and at the broadest measures eighteen miles across. Oats and barley are the principal crops raised, and much of the grain is used in the distillation of whisky, for which the island is celebrated. There are about fourteen distilleries upon it, and the trade thus carried on has been the means of greatly improving the condition of Islay. In 1821 the population amounted to 11,008, and in 1831 to 19,780. See SCOTLAND.

ILANCE, a town of Switzerland, in the canton of the Grisons. Though small, it is a kind of capital, being the place where the authorities of the canton assemble. It is in a most picturesque situation, at the foot of a mountain, where the river Glenner falls into the Rhine. It has little or no trade, and the population scarcely amounts to 1000. It is, however, a city, being surrounded with walls.

ILBESSAN, a city of European Turkey, the capital of the circle of that name, in the province of Rumelia. It is situated on the river Uschkowobin, on a fruitful plain, is the seat of a Greek bishop, has a castle which repelled the attacks of Scanderbeg, and 3000 inhabitants.

ILCHESTER, a small borough town of the county of Somerset, in the hundred of Tintinhull, 122 miles from London. It stands upon the river Ivel, one of the branches of the Parel, which is navigable within three miles of the town. It was once a fortified city, and the remains of the Roman fortifications may still be traced. It is the town where county elections are held, where the jail stands, and where criminals are executed; but the assizes are removed to the larger towns, Wells, Taunton, and Bridgewater. It formerly returned two members to the House of Commons, chosen by the householders, but was disfranchised in 1832. It is remarkable as the birth-place of Roger Bacon. There is a small market on Wednesday. The inhabitants amounted in 1801 to 817, in 1811 to 610, in 1821 to 802, and in 1831 to 1095.

ILDEFONSO, a town of Spain, in the province of Segovia. It is situated on the northern declivity of the Guadarama Mountains, 3000 feet above the level of the sea. It contains about 5000 inhabitants, who are mostly employed in making glass in a royal manufactory, which during the Peninsular war was abandoned, but has since been re-established. It was long celebrated for the large size of the mirrors fabricated in it, some of which were twelve feet high and seven feet wide. Here is also a royal palace, generally inhabited by the court in the few hottest months of summer. This palace, called the Granja, from having been originally a barn, has been highly decorated by a valuable gallery of pictures, and many other curiosities. It has also a fine garden laid out in the French taste, and embellished with all kinds of water-works, resembling those constructed at Versailles, but superior, from the river Eresma, which supplies them, descending with great rapidity from the mountain. This place is about forty miles north-west from Madrid, and six miles from Segovia.

ILERDA, in *Ancient Geography*, the capital of the Iligertes, situated on an eminence between the rivers Sicoris and Cinga; a city often besieged and often taken, because exposed to incursions from Gaul, and under Gallienus destroyed by the Germans. Ilerda, now Lerida, on the river Segre.

ILEX, the holm or holly-tree, a genus of plants belonging to the tetrandria class, and in the natural method ranking under the forty-third order, *Dumosæ*. See BOTANY.

ILFORD, a hamlet properly, but really a town, of the county of Essex, in the hundred of Beacontree. It is within the parish of Barking, but is a chapelry, with its own church. It stands on the great road from London to Yarmouth and Ipswich, at the distance of seven miles from Whitechapel church. The river Roding runs through it in its way to the Thames, in several branches, over which bridges are thrown. The population amounted in 1801 to 1724, in 1811 to 2462, in 1821 to 2972, and in 1831 to 3512.

ILFRACOMBE, a port and market-town of the county of Devon, 202 miles from London, in the hundred of Braunton. It is situated on the Bristol Channel, with a good harbour, but dry at low water. It is much visited for sea bathing, and is the principal passage from Devonshire to South Wales. The inhabitants amounted in 1801 to 1838, in 1811 to 1934, in 1821 to 2622, and in 1831 to 3201.

ILIAC PASSION, a violent and dangerous kind of colic, which takes its name from the intestine ilion, on account of its being usually affected in this distemper; or perhaps from the Greek verb εἰλεῖν, *to wind* or *twist;* and hence also it is by the Latins called *volvulus*. See MEDICINE.

ILIAD, the name of an ancient epic poem on the subject of the taking of Troy, being the first and best of the epics composed by Homer. The Iliad is divided into twenty-four books or rhapsodies, which are marked with the letters of the alphabet.

ILIMSK, a town of Asiatic Russia, situated on the Ilim, which falls into the Anguri. In the environs are found the most beautiful black sables. It contains 107 houses, and 531 inhabitants. It is 152 miles north of Irkutsk.

ILISSUS, a river to the east of Athens, which, uniting with the Eridanus on the west side, falls into the sea below the city. It was sacred to the muses, called *Iliassides;* and on its bank stood their altar, where the lustration in the lesser mysteries was usually performed.

ILIUM, or ILION, in *Ancient Geography*, a name for the city of Troy, but most commonly used by the poets, and distinguished by the epithet *Vetus*, ancient. According to Strabo, the ancient city was thirty stadia farther east than New Ilium. The position of the latter is, according to Dr Clarke, upon a low eminence, about three miles from the promontory Sigeum, now called Jenitchere. New or modern Ilium was a village which Alexander, after the battle of Granicus, called a city, and ordered to be enlarged. It was afterwards adorned by the Romans, who granted it immunities as their mother city. The various disasters of the Greeks and Trojans, as described by Homer, gave rise to the proverb *Ilias Malorum*.

ILKESTON, a town of the county of Derby, in the hundred of Morleston and Litchurch, 126 miles from London. It is a place of manufacturing industry. The population amounted in 1801 to 2422, in 1811 to 2970, in 1821 to 3681, and in 1831 to 4446.

ILLECEBRUM, a genus of plants belonging to the pentandria class, and in the natural method ranking under the twelfth order, *Holoraceæ*. See BOTANY.

ILLE-VILAINE, a department of the north of France, on the sea coast, formed out of a part of the ancient province of Normandy. It extends in north latitude from 47. 39. to 48. 42. and in west longitude from 1. 13. to 2. 16. It is bounded on the north by the English Channel, on the east by the department of Mayenne, on the south by the Lower Loire, and on the west by Morbihan and the Lake du Nord. It is 2756 square miles in extent, and is divided into six arrondissements, which are subdivided into forty-three cantons and 352 communes. The population, according to the Annuaire for 1834, amounted to 547,052 individuals. They almost exclusively adhere to the Romish church, as the few Protestants are in no place sufficiently numerous to form a congregation. They are for the most part of a Celtic race, and speak a language much like that of the Welsh; and though some French words have been introduced, they are scarcely intelligible by the French people. Those on the sea coast are employed in the fisheries, and in the numerous small craft make excellent sailors. The inland inhabitants are much attached to their ancient customs, are uninstructed, and most superstitious. They live much on food composed of buck-wheat, made into a kind of pudding called *galettee*; and chestnuts form a material part of their sustenance. The country people are ill clad, generally with domestic manufactures. The estates are much divided; a farm of sixty acres is deemed a large one, and the far greater number do not exceed twelve acres. Hence they are for the most part excessively poor, and, particularly in winter, suffer much hardship. The face of the country is generally level, but with a few slight undulations. The highest of these hills are in the arrondissement of Fougeres on the east, and in that of Montfort to the west. The coast is surrounded with cliffs, and with small rocky projections; and on the borders there are artificial dams, constructed to prevent the encroachments of the sea. The rivers which give their name to the department neither rise within it, nor do they discharge their waters into the sea till they enter the adjoining province of Morbihan. The Vilaine is navigable for vessels of 200 tons by help of the tide, up to Vitrè, from whence is a communication by a canal with the town of Rance.

The soil is unfavourable to cultivation, scarcely exceeding an inch in depth, and resting on a bed of clay or slaty stone. Much of the land is covered with morasses and swamps, which, with the woods and heaths, leaves but little for agriculture, though on the sides of the rivers there is some tolerably good pasture land. The department scarcely grows sufficient corn for the inhabitants, though they use most of the lowest description. Hemp and flax are grown, and chiefly used at home. Fruit trees are abundant and productive. Some horses are bred for sale to other districts, and some cows are kept for the dairy; but the breed of sheep is much neglected. There is little trade, and few manufactures; the latter are limited to twine and sail-cloth. There is very little wine made, but abundance of cedar. The cities and towns are small. The only ones having more than 4000 persons are, the capital, Rennes, with 29,680; Fougeres, with 7677; Saint Malo, with 9890; Vitrè, with 8856; and Redon, with 4504.

ILLICIUM, a genus of plants belonging to the dodecandria class, and in the natural method ranking with those of which the order is doubtful. See BOTANY.

ILLINOIS, one of the United States of North America, is bounded on the north by the territory of Huron; on the east by Lake Michigan and the state of Indiana; on the south by the Ohio river, which separates it from Kentucky; and on the west by the Mississippi, which separates it from the state and territory of Missouri. It lies between lat. 37° and 42° 30′ north, and long. 87° 20′ and 91° 20′ west, being about 380 miles in length from north to south, and 210 miles in width from east to west, and comprehending an area of 58,900 square miles. Next to Louisiana and Delaware, this is considered as the most level state in the Union. There are a few hills, and some elevations that might be designated mountains; but by far the greater portion of the state consists of beautiful and fertile prairies, finely diversified with wood. These prairies or meadows, which are sometimes of vast extent, are distinguished by the names of wet and dry, alluvial and rolling. The wet prairies contain peat, logs of wood, and exhibit other indications of their having once been morasses in which wood grew. The origin of many of the rivers is to be traced to these prairies. Those of an alluvial nature are high and dry, of a rich black loam, which is exceedingly fertile; and they are covered with a coarse kind of grass, which grows to an enormous size. The high and rolling prairies are sometimes chequered with groves of sparse trees. Their soil is in general only of second rate quality, and they abound in springs. Grape vines are abundant; and they furnish an inexhaustible summer range for cattle. From the exceeding flatness of some of the plains, and their consequent want of inclination, the rain that falls is not carried off, but allowed to remain and stagnate, so that such situations are very unhealthy. Grand Prairie is the largest tract of land of this description. The first stratum of soil is a black, friable, and sandy loam, from two to five feet in thickness. The next is a red clay mixed with fine sand, and from five to ten feet in thickness. The third is a hard blue clay, of a beautiful appearance and greasy feel, mixed with pebbles, and, when exposed to the air, capable of emitting a fetid odour. This soil is of the first quality, and here the springs are found. Strawberries are raised in immense quantities, and of the very finest quality. Timber, however, is scarce, and good water is likewise deficient.

Between Carlisle and St Louis a tract of country fifty miles in extent, woods, streams, hills, limestone ledges, and a rolling country, present themselves. The hills here abound in stone coal, and limestone is also plentiful. A range of hills commences at the bluffs which bound the "American bottom," near Kaskaskia, and stretches north-eastwardly through the state towards Lake Michigan. Another limestone bluff breaks off almost at right angles to this chain, and stretches along the margin of the American bottom to the point nearly opposite the Missouri. This bluff has in many places a regular front of perpendicular limestone, not unfrequently 300 feet in height. There are other chains of bluffs, which are marked by the same grand natural features. The American bottom commences not far below Kaskaskia, and stretches eighty miles along the shores of the Mississippi. It is from three to six miles in width, and forms two belts, the one, which borders the Mississippi, having a heavy timbered bottom, and the other, which reaches the foot of the perpendicular bluffs, being prairie of the richest quality. For above one hundred years crops of maize have been raised on some parts of this tract, without the slightest exhaustion of soil having become apparent. Vegetation here flourishes most luxuriantly; but there is a counterbalance in the unhealthiness of the climate, particularly during autumn. On either bank of the Illinois, almost from its mouth to its source, there is a similar bottom, with bluffs and chains of hills similar to the preceding. The military bounty tract, which is distributed amongst the soldiers of the late war, commences in the neighbourhood of Lower Alton. It comprehends the north-west corner of the state, about 170 miles long and sixty broad, and is situated between the rivers Mississippi and Illinois. This district of country has great advantages; the soil is rich and extremely fertile, and much of the prairie ground is eminently beautiful; but the situation is unhealthy. Not only in this state, but over all the western territory, the lands seem to be distributed in bodies, either of rich or sterile, or of level or broken lands. On Rock River, the Illinois, the Kaskaskia, Embarras, between the Big and Little Wabash, on the Parassaw, the Macoupin, the Sangamon, and on all the other considerable streams of this state, there are very large tracts of first-rate land. The Grand Prairie, the Mound Prairie, the prairie upon which the marine settlement is fixed, and that occupied by a society of Christians from New England, are all exceedingly rich. The Sangamon district of country, in particular, presents a happy proportion of timbered and prairie lands, and a soil of great fertility, whilst accounts from various quarters concur in representing it as more healthy than any other part of the state. The prevailing trees are, the locust, black walnut, and pecean; and there is a vast summer range for cattle. Iron and copper ore, salt springs, gypsum, and stone coal, are abundant; and the whole district is now divided into a number of populous counties, and is thickly settled by thriving farmers. Along the course of the Kaskaskia or Okau, tracts of land equally extensive and fine are stretched. This river has a long course through the central parts of the state, and a country beautifully diversified with hill, vale, prairie, and forest. On its banks is Kaskaskia, formerly the seat of government; and Vandalia, at present the metropolis. A late traveller (Stuart, *Three Years in North America*, vol. ii. p. 379) thus speaks of Illinois: "The general description of the state of Illinois is, that it contains 58,900 square miles; is the fourth state in point of extent in the union, only inferior in this respect to Virginia, Georgia, and Missouri, with a general level, not varying above sixty feet; and that it consists, with little interruption, of one vast prairie of admirable soil, extending from the Mississippi to Lake Michigan. It is the richest country in point of soil in the world. The French called it the terrestrial paradise."

Count Marbois thus writes of this country generally: "At the junction of the Mississippi and Missouri, the lands lying towards the north-west are of admirable fertility. Emigration already inclines there; and these districts, though very remote from the sea, will one day be as well peopled as any other country in the world. The Mississippi, the Missouri, the Arkansas, and the Red River, and their tributaries, water 200,000 square leagues within the space of country called the basin of the Mississippi. This internal navigation, prepared by nature, has already been wonderfully extended and improved by canals, excavated by the labour of man; and steam-boats descend and ascend against wind and tide, brave the most rapid currents with more speed, and with more convenience, than the finest roads in Europe can be travelled. Wood and coal, indispensable agents in this navigation, abound on the shores of the rivers; and the steam-engine has put an end to the difficulty of communication, heretofore one of the greatest obstacles that were ever opposed to the improvement of colonies."

Illinois is particularly fortunate, not only in the number, but in the navigability, of its rivers. For a great distance on its northern extent it has the waters of Lake Michigan, and the boatable streams that are therein discharged; and by this means a communication is opened with the northern fronts of Indiana and Ohio, with New York and Canada. On the north-west is Rock River, a long, beautiful, and boatable tributary of the Mississippi. Its whole western front is washed by the latter river, and its northern by the Ohio. On the east is the Wabash, which has a course of about 130 miles, the greater part of it being navigable; and through its centre winds in one direction the Illinois, which connects the Mississippi with Lake Michigan by the Plein and Kankakee, whilst in another direction the Kaskaskia traverses the state for a distance of between 200 and 300 miles. At present the state is supposed to include 4000 miles of boatable waters within its limits. The Illinois, which gives name to the state, may be considered as the most important river in North America, having its whole course within one state. It is formed by the junction of two other rivers in the north-west part of Indiana, and, passing into Illinois, pursues generally a south-westerly direction, and flows into the Mississippi twenty-one miles above the Missouri. It is upwards of 400 yards wide at its mouth, is about 400 miles long, and is of easy navigation. Its current, which is very gentle, is unbroken by falls or rapids, and it passes through a fine country.

In this state there are prodigious lead mines, as well as those of coal and lime. There is also building stone in the bounty tract. Specimens of native malleable copper have been found, weighing from one to three pounds. On the Saline River, a branch of the Ohio, are salt springs, from which salt is manufactured at a cheap rate. About 300,000 bushels of this article are annually made. The lead mines are situated at Galena, on Fever River, near the north-west corner of the state. The working of them commenced in 1821, and in 1824 there were made 175,220 lbs. of lead. In the year 1829 the produce had amounted to 13,343,150 lbs.

The prevailing forest tree in Illinois is oak, of which thirteen or fourteen different species are enumerated. Throughout the territory there are also found honey locust, black walnut, mulberry, plum, sugar maple, black locust, elm, bass-wood, beech, buck-eye, hack-berry, coffee-nut, sycamore, spice-wood, sassafras, black and white haws, crab-apple, wild cherry, cucumber, and pawpaw. White pine is found on the head branches of the Illinois. The chief produce of the state is Indian corn, wheat, and the other agricultural productions of North America. From the extent and fertility of the soil, those articles which it is best adapted for are raised in far greater quantities than are requisite for the home consumption of the state. The immense prairies afford abundance of food for cattle, and grazing is extensively carried on. Great numbers of fine cattle and horses are regularly sent to New Orleans. Most of the clothing of the people is of domestic manufacture. The climate of Illinois does not materially differ from that of the same latitudes in the Atlantic states. The low and wet lands in the southern part are unhealthy, and the cold of winter is in some parts exceedingly severe. Amongst the diseases which afflict this state is one called the *milk sickness*, with which cows are seized, particularly in autumn, when the first severe frost begins. It is supposed to be occasioned by the eating of a luxuriant poisonous vine, to which the animals are compelled at this season of the year to have recourse for sustenance. Milk taken in any quantity seems to produce the same disease in other animals, and even in men, and it very often proves fatal.

We shall now describe a few of the principal towns of this state. Vandalia, the political metropolis, is pleasantly situated on a high bank of the Kaskaskia river, in the centre of a rich and thriving country. Although only founded a few years since, it contains many handsome brick buildings; and respectable houses for the accommodation of the government and the courts have also been erected. Edwardsville, on Cahokia Creek, twenty miles north-east from St Louis, is a county town of some consequence, and was, until within a few years, the seat of government. Belleville is in the centre of Turkey Hill settlement, eighteen miles south-east of St Louis, and a few miles east of the American bottom. It is a flourishing village, in the midst of a compact settlement, and most excellent lands. Alton is a new village, a little above the mouth of the Missouri. Its position is favourable, the situation is healthy, and it promises to become a considerable town. Carlisle is situated on the western bank of the Kaskaskia, on the great road from Cincinnati to St Louis. Boats of burthen can ascend the river to this place when the water is favourable. Cahokia is situated in the American bottom, on a creek of the same name, a few miles below St Louis. It is one of the most ancient villages in the county, is of considerable extent, and chiefly inhabited by French. There is another French village of about the same size, called Prairie du Rocher. It is situated near a most beautiful limestone bluff, twelve miles above Kaskaskia. Kaskaskia is situated on an extensive plain, not far from the commencement of the American bottom, eleven miles from the mouth of the river on which it stands, and six miles from the nearest point of the Mississippi. This town was one of the first establishments made by the French in the valley of the Mississippi, and is a place of higher antiquity than Philadelphia. It was once of greater importance than it is at present, the inhabitants, which were formerly 7000 in number, being now reduced to 1000. It is beautifully situated in the centre of a gently sloping basin, on a fine navigable stream, and in the midst of a country proverbial for its fertility. It is the seat of justice for the county to which it belongs, and has a bank, a printing-office, a Catholic church, and a land-office. At about three hundred miles west from Vandalia stands Galena, which owes its origin to the rich lead mines in the vicinity. It contains forty-two stores and warehouses, between 200 and 300 dwelling-houses, and 1000 inhabitants. There is here a weekly journal, and the usual concomitants of a county seat. About 10,000,000 pounds of lead are annually exported from this place. The population in the vicinity is estimated at 10,000. Shawneetown is situated on the Ohio, nine miles below the mouth of the Wabash. The great United States Saline, situated twelve miles from this town, contributes to give it consequence. It is the seat of justice for its county, and has a bank with a large capital, and a land-office. Besides these, there are a number of towns or villages, which, however, do not require particular notice.

The territory of Illinois was formed into a state and admitted into the Union in 1818. By the constitution no more slaves can be admitted into the state. The legislative power is vested in a general assembly, consisting of a senate and a house of representatives. The senators are chosen for periods of four years, and the representatives biennially. The executive power is vested in a governor, who is chosen for four years, and is ineligible for the succeeding four years. There is a supreme court established by the constitution, and there are inferior courts established by the general assembly. The judges who are appointed by the assembly hold their places during good behaviour, but can be removed by the governor on an address of two thirds of each branch of the general assembly. Schools are supported by a grant of land amounting to a thirty-sixth part of each township; and three per cent. of the net proceeds of the United States' lands sold within the state is appropriated for the encouragement of learning, of which a sixth part is required to be bestowed on a college or university. A further provision has been made for a university, by the grant of two townships of land by the United States. Illinois college, situated at Jacksonville, was founded in 1829, and has a fund of 13,000 dollars.

Though this state is in general favourable for the construction of roads, yet the low and clayey prairies are exceptions. Rivers furnish the most convenient means of transport, and various canals, which will make up for any deficiency, are in contemplation. It is also proposed to extend the national road from Indianapolis to Vandalia, and thence to St Louis. The history of this state forms part of that of Louisiana, under which head it will be given. With regard to the native Indians, they have by different treaties ceded the greater part of their territorial claims to lands; and those who still roam at large are rarely seen, excepting on the skirts of the state, in the character of hunters, or of vagrants. This state is divided into forty-eight counties, and the census of 1830 gives the population as follows: Whites, 155,176; slaves, 746; making the total 157,575. The number of inhabitants has been tripled in ten years. (R. R. R.)

ILLOGAN, a town of the hundred of Penwith, in the county of Cornwall, 266 miles from London. It is in a mining district, which affords employment to the people, especially in one of the richest of the copper mines, called Cook's Kitchen, which is within the parish. The inhabitants amounted in 1801 to 2895, in 1811 to 4078, in 1821 to 5170, and in 1831 to 6072.

ILLUMINATI, the name of a secret society or order in Germany and other countries of Europe, whose professed object, it is said, was to propagate the purest principles of virtue; but whose real views were to subvert every established government and religion, and, by delivering mankind from the necessary and salutary restraints of civil society, to bring them to an imaginary state of freedom and independence. Of this order much has been said and written; but that any society existed, regularly organized in the way which this is represented to have been, working in secret, and at the same time possessing extensive power and influence, has not been established by any kind of proof.

ILLUMINATING, a kind of miniature painting, anciently much practised for illustrating and adorning books. Besides the writers of books, there were artists whose profession it was to ornament and paint manuscripts, and who were called illuminators. The writers of books first finished their part, and the illuminators embellished them with ornamented letters and paintings. We frequently find in manuscripts blanks left for the illuminators, which, however, were never filled up. Some of the ancient manuscripts were gilt and burnished in a style superior to those of later times. The colours were excellent, and the skill in preparing them must have been very great.

The practice of introducing ornaments, drawings, emblematical figures, and even portraits, into manuscripts, is of great antiquity. Varro wrote the lives of seven hundred illustrious Romans, which he enriched with their portraits, as Pliny attests (*Hist. Nat.* lib. xxxv. chap. 2). Pomponius Atticus, the friend of Cicero, was the author of a work on the actions of the great men amongst the Romans, which he ornamented with their portraits, as we are informed by Cornelius Nepos in his life of that illustrious Roman. But these works have not been transmitted to posterity. There are, however, many precious documents remaining, which exhibit the advancement and decline of the arts in different ages and countries. These inestimable paintings and illuminations display the manners, customs, habits ecclesiastical, civil, and military, weapons and instruments of war, utensils and architecture, of the ancients; and they are of the greatest use in illustrating many important facts relative to the history of the times in which they were executed. In these treasures of antiquity are preserved a great number of specimens of Grecian and Roman art, which were executed before the arts and sciences fell into neglect and contempt. The manuscripts containing these specimens form a valuable part of the riches preserved in the principal libraries of Europe; the Royal, Cottonian, and Harleian Libraries, as also those in the two universities of England, the Vatican at Rome, the Imperial at Vienna, the Royal at Paris, St Mark's at Venice, and many others.

A very ancient manuscript of Genesis, which was in the Cottonian Library, and almost destroyed by a fire in 1731, contained two hundred and fifty curious paintings in water-colours. Twenty-one fragments, which escaped the fire, have been engraved by the Society of Antiquaries of London. Several specimens of curious paintings also appear in Lambecius's catalogue of the Imperial Library at Vienna, particularly in volume third, where forty-eight drawings of nearly equal antiquity with those in the Cottonian Library are engraven; and several others may be found in various catalogues of the Italian libraries. The drawings in the Vatican Virgil, executed in the fourth century, before the arts were entirely neglected, illustrate the different subjects treated of by the Roman poet. A miniature drawing is prefixed to each of the gospels brought over to England by St Augustin in the sixth century, which is preserved in the library of Corpus Christi College, Cambridge. In the compartments of those drawings are depicted representations of several transactions in each gospel. The curious drawings and elaborate ornaments in St Cuthbert's gospels, made by St Ethelwald, and now in the Cottonian Library, exhibit a striking specimen of the state of the arts in England in the seventh century. The same observation may be made respecting the drawings in the ancient copy of the four gospels preserved in the cathedral church of Lichfield, and those in the *Codex Rushworthianus* in the Bodleian Library at Oxford. The life of St Paul the Hermit, now remaining in Corpus Christi College, Cambridge, affords an example of the style of drawing and ornamenting letters in England in the eighth century; and the copy of Prudentius's *Psycomachia* in the Cottonian Library exhibits the style of drawing in Italy in the ninth century. Of the tenth century there are Roman drawings of a singular kind in the Harleian Library, No. 2820; whilst Nos. 5280, 1802, and 432, in the same library, contain specimens of ornamented letters, which are to be found in Irish manuscripts from the twelfth to the fourteenth century. Cædmon's Poetical Paraphrase of the book of Genesis, written in the eleventh century, which is preserved amongst Junius's manuscripts in the Bodleian Library, exhibits many specimens of utensils, weapons, instruments of music, and implements of husbandry, used by the Anglo-Saxons. The like may be seen in extracts from the Pentateuch of the same age in the Cottonian Library. The manuscript copy of Terence in the Bodleian Library displays the dresses, masks, &c. worn by comedians in the twelfth century, if not earlier. The very elegant Psalter in the library of Trinity College, Cambridge, exhibits specimens of the art of drawing in England in the same century. The Virgil in the Lambeth Library of the thirteenth century, and written in Italy, shows, both by the drawings and writing, that the Italians produced works much inferior to ours at that period. The copy of the Apocalypse, in the same library, contains a curious example of the manner of painting in the fourteenth century. The beautiful paintings in the history of the latter part of the reign of King Richard II., in the Harleian Library, afford curious specimens of manners and customs, both civil and military, at the close of the fourteenth and in the beginning of the fifteenth century. Many other instances might be produced; but those who desire further information may consult Strutt's *Regal and Ecclesiastical Antiquities*, and his *Horda Angelcynnan*, published in three volumes.

This art was much practised by the clergy, and even by some in the highest stations in the church. "The famous Osmund," says Bromton, "who was consecrated Bishop of Salisbury, A. D. 1076, did not disdain to spend some part of his time in writing, binding, and illuminating books." Mr Strutt, as already noticed, has given the public an opportunity of forming a judgment as to the degree of delicacy and art with which these illuminations were executed, by publishing prints of a prodigious number of them, in his *Regal and Ecclesiastical Antiquities of England*, and his *View of the Customs of England*. In the first of these works we are presented with the genuine portraits, in miniature, of all the kings and several of the queens of England, from Edward the Confessor to Henry VII. mostly in their crowns and royal robes, together with the portraits of many other eminent persons of both sexes.

The illuminators and painters of this period seem to have been in possession of a considerable number of colouring materials, and to have known the arts of preparing and mixing them, so as to form a great variety of colours; for, in the specimens of their miniature-paintings which are still extant, we perceive not only the five primary colours, but also various combinations of these. Though Strutt's prints do not exhibit the bright and vivid colours of the originals, they give us equally a view, not only of the persons and dresses of our ancestors, but also of their customs, manners, arts, and employments, their arms, ships, houses, and furniture, and enable us to judge of their skill in drawing. The figures in these paintings are often stiff and formal; but the ornaments are in general fine and delicate, and the colours clear and bright, particularly the gold and azure. In some of these illuminations the passions are strongly represented. Terror, for example, is strongly painted in the faces of the Earl of Warwick's sailors when they were threatened with a shipwreck, and grief in the countenances of those who were present at the death of that hero. After the introduction of printing, this elegant art of illuminating gradually declined, and at length became quite neglected.

Before concluding, it may not be improper to observe, that from the fifth till the tenth century, the miniature paintings which we meet with in Greek manuscripts, are generally good, as are also some which we find amongst those of Italy, England, and France. From the tenth till the middle of the fourteenth century they are commonly very bad, and may be considered as so many monuments of the barbarism of those ages; but towards the latter end of the fourteenth, the paintings in manuscripts were much improved; and in the two succeeding centuries many excellent performances were produced, especially after the restoration of the arts, when great attention was paid to the works of the ancients, and the study of antiquity became fashionable.

ILLUMINATORS. See ILLUMINATING.

ILLUMINED, ILLUMINATI, a term anciently applied to such persons as had received baptism. This name was occasioned by a ceremony in the baptism of adults, which consisted in putting a lighted taper in the hand of the person baptized, as a symbol of the faith and grace which he had received in the sacrament.

ILLUMINED, *Illuminati*, is also the name of a sect of heretics who sprang up in Spain about the year 1575, and were called by the Spaniards *Alambrados*. Their principal doctrines were, that by means of a sublime manner of prayer, which they had attained to, they entered into so perfect a state, that they had no occasion for ordinances, sacraments, or good works; and that they could give way even to the vilest actions without sin. The sect of Illumined was revived in France in the year 1634, and was soon afterwards joined by the Guerinets, or disciples of Peter Guerin, who together formed but one body, called also *Illumined;* but being hotly pursued by Louis XIII. they were soon destroyed. The brothers of the Rosy Cross are sometimes also called *Illumined*. See ROSYCRUCIAN.

ILLUSTRIOUS, ILLUSTRIS, in the Roman empire, a title of honour peculiar to people of a certain rank. It was first given to the most distinguished amongst the knights, who had a right to bear the *latus clavus;* but afterwards those only were entitled *illustrious* who held the first rank amongst the persons called *honorati*, that is, the *præfecti prætorii*, *præfecti urbis*, treasurers, comites, and others. The Novels of Valentinian distinguish as many as five kinds of *illustres*, amongst whom the *illustres administratores* bear the first rank.

ILLYRIA, or ILLYRICUM, ANCIENT, a country situated on the east coast of the Adriatic, the limits of which were at no time distinctly marked. In its most restricted sense it may be considered as extending from Dalmatia on the north, to Epirus on the south, from which it was separated by the Acroceraunian range of mountains. To the east it was separated from Macedonia by a lofty chain of mountains, which was known under the several names of Bertiscus, Scardus, *Tschar Dagh*, and Bernus. When the Romans conquered the country, they added to it the Dalmatians, Japydes, and other petty tribes; and, under the emperors, so widely were the frontiers of Illyria extended, that it comprehended the great districts of Pannonia, Rhætia, Noricum, and Mœsia (Appian, *Illyr.* 6). In the third century we find *Duces totius Illyrici* mentioned, under whose command were placed not only the troops of the above-mentioned countries, but also those of Thrace. When the Roman empire was divided into two parts, they each received a portion of Illyria. The western portion comprehended Dalmatia, Pannonia, and Noricum, and belonged to the *Præfectus prætorio Italiæ.* It is remarked by Strabo (vii. 317), that the coast of Illyria presented everywhere good harbours, whilst the opposite side of Italy was entirely devoid of them. The climate was excellent, and the soil in general such as to produce olive trees and vines. In the interior, however, the country is mountainous, and covered with snow during a great part of the year.

Illyria was inhabited by a great number of different tribes, of whom we shall mention the principal. In the north were the Japydes, the Liburni, celebrated as a maritime people, and the Dalmatæ, whose chief city was Salon, now *Salona.* The Scordisci, it would appear, were an Illyrian people, reaching as far as the river Danube. More to the south were the Dardani, who occupied the upper valleys of the river Drilo, and extended to the frontiers of Pæonia and Macedonia. The most interesting part, however, of Illyria was that which extended along the coast for nearly ninety miles, from the Gulf of Drino and the vicinity of Lissus, to the Acroceraunian Mountains and the confines of Chaonia. There we find the important towns of Epidamnus, Apollonia, Oricum, and in the interior the Atintanes, and the Dassaretii with their capital Lychnidus, situated on a great lake of the same name. Its chief rivers were the Drilo, formed by two branches, which rise nearly two hundred miles apart, and the northern branch of which is now called the *White Drino,* whilst the southern, rising in the lake Lychnitis, is called the *Black Drino;* the Apsus, now *Crevasta* or *Beratino;* the Aous, *Voioussa,* which rises in the range of Pindus, on the confines of Thessaly and Macedonia, and which separated Epirus from Illyria.

Respecting the origin of the Illyrian people we have little information on which we can depend. Their vicinity to the Thracians, and the peculiar practice of tatooing their bodies, would lead us to connect them with that important people; yet it is curious that ancient writers always distinguish them, and when they both served as light troops in the army of Alexander they formed separate bodies. Of their early history we know nothing, nor are they mentioned till the reign of Amyntas, king of Macedonia, B. C. 383, when we find Bardylis, a leader of banditti, elected king by his followers. His power increased daily, and he at last included within his kingdom all that part of Illyria which lies along the sea-coast. He attacked Macedonia, and defeating its king Amyntas, took several of its cities (Diodor. xv. 15, 19); and again, B. C. 359, we find him at war with Perdiccas, who fell in an engagement with the Illyrians (xvi. 2). The same year, however, he was defeated by Philip, the father of Alexander the Great, who succeeded on the death of Perdiccas, and was obliged to surrender all the cities and districts which he had taken from Macedonia (xvi. 4). Bardylis was succeeded by his son Clitus, who made an unsuccessful attempt to recover from Alexander that portion of Macedonia which his father had been compelled to give up (Arrian, i. 5). Clitus was succeeded by his son Pleuratus, and he again by Agron, a powerful prince, who ruled over the Dalmatians, the Greek colonies in the islands Issa, Corcyra, and Melæna, and also some of the Greek cities in Epirus. The Greeks, however, were by no means willing to be subject to one whom they considered as a barbarian, and they applied for assistance to the Romans, who were at that time beginning to interfere in the affairs of Greece. Besides, the Roman merchants had suffered considerably from the piracy of the Illyrians. The remonstrances of the Romans were little attended to, and whilst preparations were making for an effective attack, Agron died, and was succeeded in the government of Illyria by his queen Teuta. The year B. C. 229, the Romans first landed on the coast of Illyria, and before the end of the year they had so humbled the pride of the Illyrians that they were glad to sue for peace, which was granted on condition that they should give up the greater portion of the coast, and agree that no armed vessel should sail south of the Gulf of Lissus. The islands were declared free, and the country taken from the Illyrians was made over to Demetrius, whose treachery had proved the principal means of the success of the Romans. The Illyrian princes seem to have lived quietly within the bounds which the Romans had assigned them, nor do they appear to have made any attempt to recover their dominions, till the reign of Gentius, great-grandson of Agron, who was induced to join Perseus, king of Macedonia, B. C. 168, in his attack on the Romans. Thirty days were sufficient to finish the war with the Illyrians; and Gentius, with his whole family, having fallen into the hands of the conqueror, was sent to Rome to grace the prætor's triumph. From that time Illyria was considered as a Roman province, and though some portion of the country was at times rebellious, it generally submitted to the power of the Romans. (Appian, *Illyrica,* Liv. xliv.)

ILLYRIA, *Modern,* a province of the empire of Austria, which in the nomenclature of the government is classed by the name of a kingdom. When the Romans had made themselves masters of the Danube, the Save, and the Drave, they united all the country to the south of Noricum and Pannonia into a province, to which they gave the name of Illyricum. When the western Roman empire fell to pieces, and, through the pressure of the northern invaders, Byzantium was deprived of its outworks, that province lost its name, and was only distinguished by the Austrians as the Hungarian provinces to the south of the Drave.

By the peace of Presburg in 1809, these portions of country were ceded to Bonaparte, and with them also Villach, Friuli, Istria, and a part of Tyrol, to which afterwards Dalmatia was added; and they were constituted a portion of his vast empire, under the name of the Illyrian Provinces. The campaigns of 1813 and 1814, with the treaty of Vienna which followed as the consequence of these, gave back these provinces to the ancient ruler. Dalmatia, the military frontier, and the Tyrol, were detached from them; and in 1822 they were further diminished by the erection of Croatia into a separate government.

This kingdom is, for political purposes, divided into two parts, with separate chiefs; one in the north, denominated, from its capital, Laybach; and the other in the south, from the same cause called Trieste, but sometimes distinguished as the division of the sea-shore.

This kingdom extends in north latitude from 44° 59′ to 47° 8′, and in east longitude from 12° 36′ to 16° 27′. It is bounded on the north by the Austrian province of the Upper Ens, by Steyermark, and Civil Croatia; on the east by Military Croatia; on the south by the Adriatic Sea; and on the west by Venetian Lombardy and the Tyrol. The extent and population of the several districts are,—

In the North.	Extent in Square Miles.	Population in 1833.
Klagenfurth	1560	174,600
Villach	1760	131,200
Laybach	1364	166,400
Neustadt	1276	193,900
Adelsburg	1186	91,500
In the South.		
Trieste	39	58,200
Gorz	1910	171,000
Istria	2210	204,000
	11,305	1,200,800

The surface of the land is penetrated throughout with

Illyria. chains of high mountains, having some of their points very lofty, between which are valleys, some of greater, others of less extent. The sea-coast is generally flat and sandy, particularly to the westward, and abounds in morasses. The bay of Trieste on the east, and that of Quarnaro on the west, run far up into the land, and thus form the great peninsula of Istria. The valleys in the districts of Villach and Klagenfurth are stony, but have a soil of moderate fertility. In Karlstadt there is an excess of wood. The districts of Laybach, Neustadt, and Adelsburg, are full of stone quarries, marshes, and sand-hills, and are very unproductive. In the districts on the coast, the want of water is sometimes much felt. A range of mountains near Laybach divides the course of the waters, which on the north of it run to the Save and the Drave, and through them to the Black Sea; whilst those rivers in the south of the range discharge their water into the Adriatic.

The great ranges of mountains already noticed may be divided into three classes, all of which take their direction from east to west. 1*st*, The Noric Alps, which cover the northern parts of the districts of Villach and Klagenfurth. The names of the particular parts are various, but the loftiest portion is the Great Glockner, the highest points of which are 11,980 feet above the level of the sea, and are covered with snow during the whole year. From it a projection extends to the south, and separates Klagenfurth from the province of Steyermark. 2*d*, The Carinthian Alps. This range is divided into two branches, one of which extends to Steyermark, and the other terminates with the massive Terklow, from which a lower branch is continued to the river Save. 3*d*, The Julian Alps. These begin with the Terklow, which is 6500 feet in height, and run quite to the Adriatic Sea. It is a characteristic of these Julian mountains, that they are all of calcareous formation, and are filled with an incredible number of caverns and grottos. From Isonzo to the frontier of Bosnia more than a thousand of these are remarked; and it has been supposed that the whole of the mountains in question are filled with such natural excavations. Many small streams flow under as well as upon the earth; they are visible for a short space, and then bury themselves in the bowels of the earth. The washing of such streams causes a sinking of the land in many parts in the form of a funnel, which has a very remarkable appearance. The whole district, but especially the eastern part, from the peculiar formation, the numerous caverns, the subterranean rivers, the lakes, cascades, and other curiosities, presents many natural phenomena, such as are unknown in any other part of Europe.

The population consists of several original tribes, mostly of the Sclavonian race. The original language is still retained, but with a great variety of dialects, by which they may still be traced up to the countries whence they emigrated twelve or thirteen centuries ago. They adhere to their ancient customs, dress, food, and amusements, and rarely intermarry with any of the families of German origin. They are mostly occupied in agriculture, though some are employed in the mines, and a few in the towns and cities in the several kinds of labour. Their number exceeds 800,000 persons. The next are the Germans, some cultivators, others mechanics or traders, who are stated to be rather more than 300,000. Besides, there are about 60,000 Italians, residing chiefly on the Adriatic shores. The far greater proportion adhere to the Roman Catholic communion, and are zealously, or rather bigotedly, attached to it. They are under the ecclesiastical direction of thirteen bishops in the different cities. In the circles of Villach and Klagenfurth there are about 18,000 Lutherans, who have sixteen churches and eighteen chapels. Besides these, there are 200 Protestants reformed, 1200 Jews, and 1000 of the Greek church, all of whom have the free exercise of their several religious rites.

From the nature of the surface, agriculture can be but little productive, though it is well managed in the valleys about Villach and Klagenfurth. The corn produced is, according to Blumenbach, a million quarters of the four principal kinds; and in one year, where actual returns were made, the following products were harvested, viz. wheat 94,300 quarters, rye 185,000, barley 142,500, and oats 350,000 quarters. Though some maize, buck-wheat, and millet are raised, and though potatoes have been introduced and extended in every year, there is a deficiency to be supplied from other districts, which is paid for by the timber and wood-ware which is floated down by the rivers, and the preparation of which furnishes a great portion of the employment of labourers. Flax and hemp are cultivated; and there are in most parts abundance of fruit trees, and in the southern part great plenty of almonds, chestnuts, and walnuts. Some olives grow near Trieste; and about forty eimers, of thirty gallons each, are annually exported. The stock of cattle is small when compared with either the extent of the land or the number of the inhabitants. The northern districts yield no wine; in the south there is abundance, but most of it is of bad quality, and cannot be kept longer than a year.

The fishery gives considerable employment to the residents on the sea-shore, especially the taking of the large tunny and small sardinias, operations which are carried on by joint-stock companies. Many oysters also are taken, and the city of Vienna is supplied with them by a very expensive land-carriage.

The mining operations are very numerous, if not very extensive. The chief mines of lead are near Villach, Adelsburg has the most productive mines of quicksilver, and most of the other districts yield silver, iron, copper, antimony, sal-ammoniac, alum, or vitriol. The iron is chiefly converted into tools or utensils, particularly nails, which are exported. There is abundance of fossil coal in many parts, and some saline springs. The latter do not yield sufficient culinary salt for the consumption, and much is made by the sun on the sea-shore. Whatever shipping trade exists is conducted through the ports of Trieste or Fiume. As there are good roads in all directions, the internal trade with the other dominions of Austria is very extensive, and rapidly increasing.

The courts of law, both civil and criminal, are held at Klagenfurth, which is also the chief seat of the police, and of the treasury board for the whole kingdom.

ILLYRIUS, Mathias, Flaccus, or Francowitz, one of the most learned divines of the Augsburg confession, born in Istria, anciently called Illyria, in 1520. He is said to have been a man of considerable genius, extensive learning, and of great zeal against popery; but he was of a restless and passionate temper, which overbalanced all his good qualities, and occasioned much disturbance in the Protestant church. He published a great number of books, and died in 1575.

ILMINSTER, a town of the county of Somerset, in the hundred of Abdick, 135 miles from London. It stands in a fertile district, and has a market, which is held on Saturday. There was formerly a considerable manufacture of woollens, but it has declined, and of late years has been in some measure replaced by mills for making lace net. There is a large church, formerly conventual, and an excellently endowed grammar-school. The population amounted in 1801 to 2045, in 1811 to 2160, in 1821 to 2156, and in 1831 to 2957.

IMAGE, in a religious sense, is an artificial representation or similitude of some person or thing, used either by way of decoration and ornament, or as an object of religious worship and adoration. In the last sense it is used indifferently with the word idol.

The noble Romans preserved with great care the images of their ancestors, which were commonly made of wax or wood, though sometimes of marble or brass, and had them carried in procession at their funerals and triumphs. They placed these images in the vestibules of their houses, where they remained, even if the houses happened to be sold, it being accounted impious to displace them. It was not, however, permitted to all who had the images of their ancestors in their houses, to have them carried at their funerals. This was a distinction granted to such alone as had honourably discharged their offices; for those who failed in this respect forfeited their privilege, and in case they had been guilty of any great crime, their images were broken in pieces.

The Jews absolutely condemned all images, and did not suffer any statues or figures to be placed in their houses, much less in their synagogues or places of worship.

The use and adoration of images are subjects which have long been controverted in the world. It appears, from the practice of the primitive church, recorded by the earlier fathers, that Christians, during the first three centuries after Christ, and the greater part of the fourth, neither worshipped images nor used them in worship. However, the greater part of the Roman Catholic divines maintain that the use and worship of images are as ancient as the Christian religion itself; and to prove this, they allege a decree, said to have been made in a council held by the apostles at Antioch, commanding the faithful, that they might not err about the object of their worship, to make images of Christ, and worship them. (Baron. *ad Ann.* 102.) But no notice is taken of this decree till seven hundred years after the apostolic times, when the dispute about images had commenced. The first instance which occurs in any credible author, of images amongst Christians, is that recorded by Tertullian (*De Pudicitia*, c. 10), of certain cups or chalices, as Bellarmine pretends, on which was represented the parable of the good shepherd carrying the lost sheep on his shoulders. But this instance only proves that the church at that time did not think emblematical figures unlawful ornaments of cups or chalices. Another instance is taken from Eusebius (*Hist. Eccl.* lib. vii. cap. 18), who says, that in his time there were to be seen two brass statues in the city of Paneas or Cæsarea Philippi; the one of a woman on her knees, with her arms stretched out; the other of a man over against her, with his hand extended to receive her. These statues were said to be the images of our Saviour and of the woman whom he cured of an issue of blood. From the foot of the statue representing our Saviour, says the historian, sprung up an exotic plant, which, as soon as it grew to touch the border of his garment, was said to cure all sorts of distempers. Eusebius, however, vouches for none of these things; nay, he supposes that the woman who erected this statue of our Saviour was a pagan, and ascribes it to a pagan custom. The primitive Christians abstained from the worship of images, not, as the Romanists pretend, from tenderness to heathen idolators, but because they thought it unlawful in itself to make any images of the Deity. (Justin Mart. *Apol.* ii. p. 44; Clem. Alex. *Strom.* 5, *Strom.* 1, and *Protr.* p. 46; Aug. *de Civit. Dei*, lib. vii. c. 5, and lib. iv. c. 32; Id. *de Fide et Symb.* c. 7; Lactant. lib. ii. c. 3; Tertull. *Apol.* c. 12; Arnob. lib. vi. p. 202.) Some of the fathers, as Tertullian, Clemens Alexandrinus, and Origen, were of opinion that, by the second commandment, the arts of painting and engraving were rendered unlawful to a Christian. The custom of admitting pictures of saints and martyrs into the churches was rare in the latter end of the fourth century; but it became common in the fifth, and in the following century the custom of thus adorning churches became almost universal, both in the east and the west.

The Lutherans censure the Calvinists for breaking the images in the churches of the Catholics, looking on it as a kind of sacrilege; and yet they condemn the Romanists as idolators.

The Mahommedans have a perfect aversion to images, which has led them to destroy most of the beautiful monuments of antiquity, both sacred and profane, at Constantinople.

IMAGE, in *Rhetoric*, signifies a lively representation of any thing in discourse. Images, in discourse, are, according to Longinus, any thoughts proper to produce expressions, which present a kind of picture to the mind. But, in the more limited sense, images are such expressions as fall from us when, by a kind of enthusiasm, or an extraordinary emotion of the soul, we seem to see the things of which we speak, and present them before the eyes of those who hear us.

IMAGE, in *Optics*, a figure in the form of any object, made by the rays of light issuing from the several points of it, and meeting in so many other points, either at the bottom of the eye, or on any other ground, or on any transparent medium, where there is no surface to reflect them. Thus we are said to see all objects by means of their images formed in the eye.

IMAGINARY QUANTITIES, or *Impossible Quantities*, in *Algebra*, are the even roots of negative quantities; which expressions are imaginary, or impossible, or opposed to real quantities; as $\sqrt{-aa}$, or $\sqrt[4]{-a^4}$. For as every even power of any quantity whatever, whether positive or negative, is necessarily positive, or has the sign $+$, because $+$ by $+$, or $-$ by $-$, give equally $+$; hence it follows that every even power, as the square, for instance, which is negative, or having the sign $-$, has no possible root; and therefore the even roots of such powers or quantities are said to be impossible or imaginary. The mixed expressions arising from imaginary quantities joined to real ones, are also imaginary; as $a - \sqrt{-aa}$, or $b + \sqrt{-aa}$.

IMAGINARY Roots of an equation are those roots or values of the unknown quantity which contain some imaginary quantity. Thus the roots of the equation $xx + aa = 0$, are the two imaginary quantities $+\sqrt{-aa}$ and $-\sqrt{-aa}$, or $+a\sqrt{-1}$ and $-a\sqrt{-1}$.

IMAGINATION, a power or faculty of the mind, by which it conceives and forms ideas of things communicated to it by means of the organs of sense.

Force of IMAGINATION. See APPARITIONS.

IMAGO, in *Natural History*, is a name given by Linnæus to the third state of insects, when they appear in their proper shape and colours, and undergo no further transformation.

IMAM, IMAUM, or IMAN, a minister in the Mahommedan church, answering to a parish priest amongst us. The word properly signifies what we call a prelate, *antistes*, one who presides over others; but the Moslemins frequently apply it to a person who has the care and intendency of a mosque, and reads prayers to the people, which they repeat after him.

IMAM is also applied, by way of excellence, to the four chiefs or founders of the four principal sects in the Mahommedan religion. Thus Ali is the imam of the Persians; Abu-beker the imam of the Soonites, which is the sect followed by the Turks; and Saphii, or Safi-y, the imam of another sect.

IMAUS, in *Ancient Geography*, the largest mountain of Asia, and part of Taurus, from which the whole of India runs off into a vast plain, resembling Egypt. It extends through Scythia, as far as to the *Mare Glaciale*, dividing it into *Scythia intra Imaum*, and *Scythia extra Imaum;* and also stretching out along the north of India to the Eastern Ocean, separates it from Scythia.

IMBECILITY, a languid, infirm state of the body, which being greatly impaired, is unable to perform its usual exercises and functions.

IMBIBING, the action of a dry porous body, which absorbs a moist or fluid one.

IMBRICATED, a term used by some botanists to express the figure of the leaves of some plants, which are hollowed like an *imbrex*, or gutter-tile, or are laid in close series over one another like the tiles of a house.

IMBRO, or IMRUS, an island in the Archipelago, to the south-west of the Gulf of Saros, eighty-six square miles in extent. It has 4000 Greek inhabitants, who produce corn, wine, oil, and cotton wool, and occupy one town and several villages. Long. 25. 40. E. Lat. 40. 10. N.

IMITATION, derived from the Latin *imitare*, to represent or repeat a sound or action, either exactly or nearly in the same manner as they were originally exhibited.

IMITATION, in *Music*, admits of two different senses. Sound and motion are either capable of imitating themselves by a repetition of their own particular modes, or of imitating other objects of a nobler and more abstracted nature. Nothing perhaps is so purely mental, nothing so remote from external sense, as not to be imitable by music. Dramatic or theatrical music contributes to imitation no less than painting or poetry; it is on this common principle that we must investigate both the origin and the final cause of all the fine arts. But this imitation is not equally extensive in all the imitative arts. Whatever the imagination can represent to itself is in the department of poetry. Painting, which does not present its pictures to the imagination immediately, but to external sense, and to one sense alone, paints only such objects as are discoverable by sight. Music might appear subjected to the same limits with respect to the ear; yet it is capable of painting every thing, even such images as are objects of ocular perception alone. By a magic almost inconceivable, it seems to transform the ears into eyes, and endow them with the double function of perceiving visible objects; and it is the greatest miracle of an art, which can only act by motion, that it can make that very motion represent absolute quiescence. Imitation, in its technical sense, is a reiteration of the same air, or of one which is similar, in several parts where it is repeated by one after the other, either in unison, or at the distance of a fourth, a fifth, a third, or any other interval whatever.

IMITATION, in *Oratory*, is an endeavour to resemble a speaker or writer in those qualities regarding which we propose them to ourselves as patterns. The first historians amongst the Romans were, according to Cicero, very dry and jejune, till they began to imitate the Greeks, and then they became their rivals. It is well known how closely Virgil has imitated Homer in his Æneid, Hesiod in his Georgics, and Theocritus in his Eclogues. Terence copied from Menander, and Plautus from Epicarmus, as we learn from Horace (lib. ii. *Ep. ad August.*), who himself owes many of his beauties to the Greek lyric poets. Cicero appears, from many passages in his writings, to have imitated the Greek orators. Thus Quintilian said of him, that he expressed the strength and sublimity of Demosthenes, the copiousness of Plato, and the delicacy of Isocrates.

IMMERSION, that act by which a thing is plunged into water or any other fluid.

IMMERSION, in *Astronomy*, is when a star or planet is so near the sun, with regard to our observations, that we cannot see it; being, as it were, enveloped and hid in the rays of that luminary. It also denotes the beginning of an eclipse of the moon, or that moment when the moon begins to be darkened, and to enter into the shadow of the earth.

IMMERITIA, or IMIRETTA, or, as it is sometimes called, Iberia, a country of Asia, to the north of Persia, bounded on the east by Georgia, and on the south by the Mossain Hills; on the north it extends as far as the principal chain of the Caucasus, and on the west the Euxine and the Hippus are the frontier lines. It lies between the 43d and 44th degrees of north latitude. It is in general of a rich soil, but is greatly depopulated and neglected; the few inhabitants in the country being as little inclined to industry as the other inhabitants of the Caucasus. In 1784 it acknowledged the supremacy of Russia, but it is in a great measure independent in its internal government. The manners of the natives are rude and simple. They generally inhabit some secluded spot in woody hills or in pleasant valleys; and here, in contented solitude, the native of Immeritia avoids the incursions of his enemies in his secret retreat. They have a method, however, of calling each other together on important occasions, by means of deep-sounding tones; and on this signal being given, hundreds of people issue from places where no one could have supposed there had been a single creature. They are chiefly of Georgian origin. The principal town is Cotatis, situated on the left bank of the Phasis river; an inconsiderable place, inhabited by about eighty Jewish, Armenian, and Turkish families. The Quirilia is the only river of consequence in Immeritia. It takes its rise in the Soani ridges, and being greatly increased by the snow-streams which descend from the Georgian side of the Caucasus, enters the Phasis in the neighbourhood of Cotatis.

IMMOLATION, a ceremony used in the Roman sacrifices. It consisted in throwing upon the head of the victim some sort of corn and frankincense, together with the *mola* or salt cake, and a little wine.

IMMORTAL, that which will last to all eternity, as having in it no principle of alteration or corruption.

IMMUNITY, a privilege or exemption from some office, duty, or imposition. Immunity is more particularly understood of the liberties granted to cities and communities.

IMMUTABILITY, the condition of a thing that cannot change. Immutability is one of the divine attributes.

IMOLA, a city of Italy, of the province of Ravenna, in the papal dominions. It is situated on an island formed by two branches of the river Santerno, in a fruitful valley, surrounded by poplars, with vines entwined amongst the branches. It is the see of a bishop, and has a cathedral, fifteen churches, seventeen religious houses for the two sexes, and 8350 inhabitants, chiefly employed in producing wine. Long. 11. 30. 10. E. Lat. 44. 21. 32. N.

IMPANNELLING, in *Law*, signifies the writing down or entering into a parchment, list, or schedule, the names of a jury summoned by the sheriff to appear for such public services as juries are employed in.

IMPARLANCE, in *English Law*, a petition in court for a day, to consider or advise what answer the defendant shall make to the plaintiff's action; and hence it is the continuance of the cause till another day, or a longer time given by the court.

IMPEACHMENT, an accusation and prosecution for treason and other high crimes and misdemeanours. Any member of the lower house of parliament may impeach any one belonging either to that body or to the House of Lords. The method of proceeding is to exhibit articles on behalf of the Commons, by whom managers are appointed to make good their charge. These articles are carried to the Lords, by whom every person impeached by the Commons is always tried; and if they find him guilty, no pardon under the great seal can be pleaded to such an impeachment. 12 Will. III. cap. ii.

IMPECCABILES, in *Ecclesiastical History*, a name given to those heretics who boasted that they were impeccable, and that there was no need of repentance.

IMPECCABILITY, the state of a person who cannot sin, or a grace, privilege, or principle, which puts him out of the possibility of sinning.

The schoolmen distinguish several kinds and degrees of impeccability; that of God belongs to him by nature; that of Jesus Christ, considered as man, belongs to him by the hypostatical union; that of the blessed is a consequence of their condition; and that of men is the effect of a confirmation in grace, and is rather called *impeccance* than *impeccability*. Accordingly, divines distinguish between these two; and this distinction is found necessary in the disputes against the Pelagians, in order to explain certain terms in the Greek and Latin fathers, which without this distinction would be easily confounded.

IMPEDIMENTS, in *Law*, are such hindrances as put a stop or stay to a person's seeking his right by due course of law. Persons under impediments are those under age or coverture, *non compos mentis*, in prison, beyond sea, and the like, who, by a saving in our laws, have time to claim and prosecute their rights, after the impediments are removed.

IMPENETRABILITY, in *Philosophy*, that property of body by which it cannot be pierced by another. Thus a body which so fills a space as to exclude all others, is said to be impenetrable.

IMPERFECT, something that is defective, or which wants some of the properties found in other beings of the same kind.

Imperfect Number is that the aliquot parts of which, taken all together, do not make a sum that is equal to the number itself, but either exceed it or fall short of it; being an abundant number in the former case, and a defective number in the latter. Thus 12 is an abundant imperfect number, because the sum of all its aliquot parts, 1, 2, 3, 4, 6, makes 16, which exceeds the number 12. And 10 is a defective imperfect number, because its aliquot parts 1, 2, 5, taken all together, make only 8, which is less than the number 10 itself.

IMPERIAL, something belonging to an emperor, or empire. See Emperor, and Empire.

Imperial Cities, in Germany, were those which owned no other head but the emperor. These were a kind of little commonwealths, the chief magistrates of which did homage to the emperor; but in other respects, and in the administration of justice, they are sovereign. There were formerly a great many such cities; but since 1815 there are only four, Hamburg, Bremen, Lubec, and Frankfort.

Imperial Diet, is an assembly or convention of all the states of the empire. See Germany, and Diet.

IMPETRATION, the act of obtaining any thing by request or prayer. Imperation was more particularly used in our statutes for the pre-obtaining from the court of Rome of benefices and church-offices in England, which were at the disposal of the king and other lay patrons of the realm; the penalty of which is the same with that of provisors. 25 Edw. III.

IMPOSITION of Hands, an ecclesiastical action, by which a bishop lays his hand on the head of a person, in ordination, confirmation, or in benediction. This practice is also observed by the dissenters at the ordination of their ministers, when all the ministers present place their hands on the head of him whom they are ordaining, whilst one of them prays for a blessing on him and his future labours. This they retain as an ancient practice, justified by the example of the apostles, when no extraordinary gifts are conveyed. However, they are not all agreed as to the propriety of this ceremony, nor do they consider it as an essential part of ordination.

Imposition of hands was a Jewish ceremony, introduced not by any divine authority, but by custom; it having been the practice amongst that people, whenever they prayed to God for any person, to lay their hands on his head. Our Saviour observed the same custom, both when he conferred his blessing on children, and when he cured the sick. The apostles likewise laid hands on those upon whom they bestowed the Holy Ghost. The priests observed the same custom when any one was received into their body; and the apostles themselves underwent the imposition of hands afresh every time they entered upon any new design.

IMPOSSIBLE, that which is not possible, or which cannot be done or effected. A proposition is said to be impossible when it contains two ideas which mutually destroy each other, and which can neither be conceived nor united together. Thus it is impossible that a circle should be a square; because we conceive clearly that squareness and roundness destroy each other by the contrariety of their figure.

There are two kinds of impossibilities, physical and moral. Physical impossibility is that which is contrary to the law of nature. A thing is morally impossible, when of its own nature it is possible, but yet is attended with such difficulties that, all things considered, it appears impossible. Thus it is morally impossible that all men should be virtuous; or that a man should throw the same number with three dice a hundred times successively.

A thing which is impossible in law is the same with a thing impossible in nature; and if any thing in a bond or deed be impossible to be done, such deed or bond is void. 21 Car. I.

IMPOTENCE, or Impotency, in general, denotes want of strength, power, or means, to perform any thing.

Divines and philosophers distinguish two sorts of impotency, natural and moral. The first is a want of some physical principle, necessary to an action, or where a being is absolutely defective, or not free and at liberty to act; the second only imports a great difficulty, as a strong habit to the contrary, a violent passion, or the like.

Impotency is a term more particularly used to signify a natural inability for coition. Impotence with respect to men is the same as sterility in women There are many causes of impotence, as, a natural defect in the organs of generation, which seldom admits of a cure, and accidents or diseases; in which cases impotence may or may not be remedied, according as these are curable or otherwise. On this subject some curious and original observations by Mr John Hunter may be found in his Treatise on the Venereal Disease. He considers impotency as depending upon two causes, one of which he refers to the mind, and the other to the organs.

Impotency is a canonical disability, to avoid marriage in the spiritual court. The marriage is not void *ab initio*, but voidable only by sentence of separation during the life of the parties.

IMPRECATION (derived from *in*, and *precor*, I pray), a curse or wish that some evil may befall any one.

The ancients had their goddesses, called in Latin *Diræ*, that is, *Deorum iræ*, who were supposed to be the executioners of evil consciences. They were called *Diræ* in heaven, *Furies* on earth, and *Eumenides* in hell. The Romans owned but three of these, and the Greeks only two. They invoked them with prayers and pieces of verses to destroy their enemies.

IMPRESSING Seamen. The power of impressing seafaring men for the naval service, by the king's commission, has been a matter of much dispute, and submitted to with great reluctance; though Sir Michael Forster strenuously contends that the practice of impressing, and granting powers to the admiralty for that purpose, is of a very ancient date, and has been uniformly continued by a regular series of precedents to the present time, from which he concludes that it is part of the common law. The difficulty arises from this, that no statute has expressly declared this power to be in the crown, though many of them very strongly imply it. But whatever may be said as to the legality of this method of manning the navy, there can be no doubt that it is a gross invasion of natural liberty; and hence it has in recent times been very generally reprobated, not only as forming a great anomaly in a free country, where natural rights are in all other cases respected, but likewise as contrary to sound policy, and at variance with the principles on which recruitment ought to be conducted, excepting in those cases of imperious necessity which imply the suspension of all ordinary rights and laws.

IMPRESSION is applied to the species of objects which are supposed to make some mark or impression on the senses, the mind, and the memory. The peripatetics assert, that bodies emit species resembling them, which are conveyed to the common *sensorium*, and there rendered intelligible by the active intellect; and, when thus spiritualized, they are called *expressions*, or *express species*, as being expressed from the others.

Impression also denotes the *edition* of a book, meaning thereby the mechanical part only; whereas *edition*, besides this, includes the care of the editor, who corrected or augmented the copy, adding notes and illustrations to render the work more useful.

IMPRISONMENT, the state of a person restrained of his liberty, and detained under the custody of another.

No person is to be imprisoned but as the law directs, either by the command or order of a court of record, or by lawful warrant; or the king's process, on which one may be lawfully detained. Where the law gives power to imprison, in such case it is justifiable, provided he who does it in pursuance of a statute exactly pursues the statute in the manner of doing it; for otherwise it will be deemed false imprisonment, and consequently it is unjustifiable.

False Imprisonment. Every confinement of the person is an imprisonment, whether it be in a common prison, or in a private house, or in the stocks, or even by forcibly detaining one in the public streets. Unlawful or false imprisonment consists in such confinement or detention without sufficient authority. False imprisonment also may arise by executing a lawful warrant or process at an unlawful time, as on a Sunday; or in a place privileged from arrests, as in the verge of the king's court. This is the injury. The remedy is of two sorts; the one *removing* the injury, the other *making satisfaction* for it.

IMPROMPTU, or *Inpromptu*, a Latin word employed to signify a piece made off-hand, or *extempore*, without any previous meditation, by mere force and vivacity of imagination.

IMPROBATION, in *Scotch Law*, the name of any action brought for setting aside any deed or writing upon the head of forgery.

IMPULSION, in *Mechanical Philosophy*, a term employed to express a supposed peculiar exertion of the powers of body, by which a moving body changes the motion of another body by hitting or striking it. The plainest case of this action is when a body in motion strikes another body at rest, and puts it in motion by the stroke. The body thus put in motion is said to be *impelled* by the other; and this method of producing motion is called *impulsion*, to distinguish it from *pression*, *thrusting*, or *protrusion*.

IMPURITY, in the law of Moses, is any legal defilement. Of this there were several sorts. Some were voluntary, as the touching a dead body, or any animal that had died of itself, or any creature that was esteemed unclean; or the touching things holy by one who was not clean, or was not a priest; the touching one who had a leprosy, or who was polluted by a dead carcass, and so on. Sometimes these impurities were involuntary, as when any one inadvertently touched bones, or a sepulchre, or any thing polluted; or fell into diseases which pollute, as the leprosy. The beds, clothes, and moveables, which had touched any thing unclean, contracted also a kind of impurity, and in some cases communicated it to others.

These legal pollutions were generally removed by bathing, and lasted no longer than the evening. The person polluted plunged over head in the water, and either had his clothes on when he did so, or washed himself and his clothes separately. Other pollutions continued seven days, as that which was contracted by touching a dead body. Some impurities lasted forty or fifty days, whilst others again lasted till the person was cured.

Many of these pollutions were expiated by sacrifices, and others by a certain water or ley made with the ashes of a red heifer, sacrificed upon the great day of expiation. When the leper was cured, he went to the temple and offered a sacrifice of two birds, one of which was killed, and the other set at liberty. He who had touched a dead body, or had been present at a funeral, was to be purified with the water of expiation, and this upon pain of death. The woman who had been delivered offered a turtle and a lamb for her expiation; or, if she was poor, two turtles or two young pigeons. These impurities, which the law of Moses has expressed with the greatest care and accuracy, were only figures of other more important impurities, such as the sins and iniquities committed against God, or faults committed against our neighbour. The saints and prophets of the Old Testament were sensible of this; and our Saviour, in the gospel, has strongly inculcated that they are not outward and corporeal pollutions which render us unacceptable to God, but such inward pollutions as infect the soul, and are violations of justice, truth, and charity.

IMPUTATION, in general, the charging something to the account of one which belonged to another. Thus, the assertors of original sin maintain that Adam's sin is imputed to all his posterity; and, in the same sense, the righteousness and merits of Christ are imputed to true believers.

INACCESSIBLE, something that cannot be approached by reason of intervening obstacles.

INALIENABLE, that which cannot be legally alienated, or made over to another. Thus the dominions of the king, the revenues of the church, the estates of a minor, and the like, are inalienable, otherwise than with a reserve of the right of redemption.

INANIMATE, a body that has either lost its vitality, or that is not of a nature capable of having any.

INANITION, amongst physicians, denotes the state of the stomach when empty, in opposition to repletion.

INANITY, the scholastic term for emptiness or absolute vacuity, and implying the absence of all body or matter whatsoever, so that nothing remains but mere space.

INAUGURATION, the coronation of an emperor or king, or the consecration of a prelate; and so called from the ceremonies used by the Romans when they were received into the college of augurs.

INCA, or Ynca, a name given by the natives of Peru to their kings and princes of the blood. Pedro de Cieca, in his Chronicles of Peru, speaking of the origin of the Incas, states that that country was, for a long time, the theatre of all manner of crimes, of war, dissension, and the most dreadful disorders, till at last two brothers appeared, one of whom, called Mangocapa, having built the city of Cusco, made laws, and established order and harmony by his wise regulations, took the name of Inca, which signifies king or great lord; and this name descended to his posterity.

INCAMERATION, a term used in the chancery of Rome, for the uniting of lands, revenues, or other rights, to the pope's domains.

INCANTATION denotes certain ceremonies, accompanied with a formula of words, supposed to be capable of raising devils, spirits, &c.

INCAPACITY, in the canon law, is of two kinds; first, the want of a dispensation for age in a minor, and for legitimation in a bastard, &c., which renders the provision of a benefice void in its original; and, secondly, crimes and heinous offences, which annul provisions at first valid.

INCARNATION, in *Theology*, signifies the act by which the Son of God assumed the human nature, or the mystery by which Jesus Christ, the Eternal Word, was made Man, in order to accomplish the work of our salvation.

Incarnation (formed from *in*, and *caro*, flesh), in *Surgery*, signifies the healing and filling up of ulcers and wounds with new flesh. See Surgery.

INCARNATIVES, in *Surgery*, medicines which were supposed to assist nature in filling up wounds or ulcers with new flesh.

INCENDIARY, in *Law*, is applied to one who is guilty of maliciously setting fire to another's dwelling-house or premises. A bare intent or attempt to do this, by actually setting fire to a house, unless it absolutely burns, does not fall within the description of *incendit et combussit.* But the burning and consuming of any part is sufficient, though the fire be afterwards extinguished. It must also be a malicious burning, otherwise it is only a trespass. This offence is called arson in the English, and wilful fire-raising in the Scotch law.

Amongst the ancients, criminals of this kind were adjudged to be burned. *Qui œdes, acervumque frumenti juxta domum positum sciens, prudensque dolo malo combusserit, vinctus igni necatur.* The punishment of arson was death by the ancient Saxon laws and by the Gothic constitutions; and in the reign of Edward I. incendiaries were burned to death. The statute 8 Henry VI. c. 6, made the wilful burning of houses, under special circumstances, high treason; but it was reduced to felony by the general acts of Edward VI. and Queen Mary. This offence was denied the benefit of clergy by 21 Henry VIII. c. 1, which statute was repealed by 1 Edward VI. c. 12; and arson was held to be ousted of clergy with respect to the principal, by inference from the statute 4 and 5 Philip and Mary, c. 4, which expressly denied it to the accessory; though now it is expressly denied to the principal also by 9 Geo. I. c. 22.

INCENSE, or Frankincense, in the *Materia Medica*, a dry resinous substance, known amongst authors by the names *tus* and *olibanum.*

Incense is a perfume with which the Pagans and the Roman Catholics still perfume their temples and altars. The word comes from the Latin *incensum*, that is, *burned*, by taking the effect for the thing itself.

The burning of incense formed part of the daily service of the ancient Jewish church. The priests having drawn lots to ascertain who should offer it, the person destined took a large silver dish, in which was a censer full of incense; and being accompanied by another priest carrying some live coals from the altar, went into the temple, where, in order to give notice to the people, they struck upon an instrument of brass placed between the temple and the altar; and being returned to the altar, he who brought the fire left it there, and went away. Then the offerer of incense having said a prayer or two, waited the signal, which was the burning of the holocaust; immediately after which he set fire to the incense, the multitude continuing all the time in prayer.

INCEPTIVE, a word used by Dr Wallis to express such moments, or first principles, as, though of no magnitude themselves, are yet capable of producing results which are. Thus a point has no magnitude itself, but is inceptive of a line which it produces by its motion. So a line, though it have no breadth, is yet inceptive of breadth; that is, it is capable, by its motion, of producing a surface which has breadth.

INCEST, the crime of illicit commerce between persons who are related in a degree in which marriage is prohibited by the laws of the country. Most nations look on incest with horror.

Incest, Spiritual, a crime committed in like manner between persons who have a spiritual alliance by means of baptism or confirmation.

Spiritual incest is also understood of a vicar, or other beneficiary, who holds two benefices, the one of which depends upon the collation of the other. Such a spiritual incest renders both of these benefices vacant.

INCH, a well-known measure of length, being the twelfth part of a foot, and equal to three barleycorns in length.

Inch (contracted from the Gaelic *innis*, an island), a word prefixed to the names of different places in Scotland and Ireland.

Inch-Colm, or *Columba*, the isle of Columba, an island situated in the Frith of Forth in Scotland, and famous for its monastery. See Forth.

This monastery was founded about 1123, by Alexander I. In passing the Frith of Forth he was overtaken by a violent storm, which drove him to this island, where he met with the most hospitable reception from a poor hermit, then residing in the chapel of St Columba, and who, for the three days during which the king remained there tempest-bound, entertained him with the milk of his cow and a few shell-fish. His majesty, from the sense of the danger which he had escaped, and in gratitude to the saint to whom he attributed his safety, vowed some token of respect, and accordingly founded here a monastery of Augustines, and dedicated it to St Columba. Allan de Mortimer, lord of Aberdour, who attended Edward III. in his Scotch expedition, bestowed half of those lands on the monks of this island, for the privilege of a family burial-place in their church. The buildings erected in consequence of the piety of Alexander were considerable; and there is still to be seen a large square tower belonging to the church, with the ruins of the church, and of several other buildings. The wealth of this place in the time of Edward III. proved so strong a temptation to his fleet, then lying in the Forth, as to suppress all the horror of sacrilege and respect to the sanctity of the inhabitants. The English landed, and spared not even the furniture more immediately consecrated to divine worship. But due vengeance overtook them; for, in a storm which instantly followed, many of them perished; and those who escaped, struck with the justice of the judgment, vowed to make ample recompense to the injured saint. The tempest ceased, and they performed the promised atonement.

Inch-Keith, a small island situated in the same frith, about midway between the port of Leith and Kinghorn on the opposite shore. See Forth.

This island is said to derive its name from the gallant Keith, who so greatly signalized himself by his valour in 1010, in the battle of Barry, in Angus, against the Danes; after which he received in reward the barony of Keith, in Lothian, and this little island. In 1549 the English fleet, sent by Edward VI. to assist the lords of the congregation against the queen-dowager, landed, and began to fortify this island, the importance of which they became sensible of, after their neglect of securing the port of Leith, so lately in their power. They left here five companies to cover the workmen, under the command of Cotterel; but their operations were soon interrupted by M. Desse, general of the French auxiliaries, who took the place, after a gallant defence on the part of the English. The Scotch kept possession of the island for some years;

but at last the fortifications were destroyed by act of parliament, to prevent it from being of any use to the former. The French gave it the name of *L'Isle des Chevaux*, from its property of fattening horses. A light-house, which has proved highly beneficial to the shipping frequenting the Forth, was erected on the island in 1805.

Inch-Garvie, a small island, also lying in the Frith of Forth, near Queensferry. See Forth.

INCHOATIVE, a term signifying the beginning of a thing or action, and the same with what is otherwise called inceptive.

Inchoative Verbs denote, according to Priscian and other grammarians, verbs which are characterised by the termination *sco* or *scor* added to their primitives; as *augesco* from *augeo*, *calesco* from *caleo*, *irascor* from *ira*, and so of the rest.

INCIDENCE denotes the direction in which one body strikes on another. See Optics and Mechanics.

INCIDENT, in *Law*, is a thing appertaining to or following another which is principal. A court baron is inseparably incident to a manor, and a court of pie-powders to a fair.

Incident Diligence, in *Scotch Law*, a warrant granted by a lord ordinary in the Court of Session, for citing witnesses for proving any point, or for production of any writing necessary for preparing the cause for a final determination, or before it goes to a general proof.

INCINERATION (derived from *in*, and *cinis*, ashes), in *Chemistry*, the reduction of any substance into ashes by burning.

INCISIVE, an appellation applied to whatever cuts or divides. Thus the fore teeth are called *dentes incisivi*, or cutters; and medicines of an attenuating nature, incidents, or incisive medicines.

INCLE, a kind of tape made of linen yarn.

INCLINATION, a term used by mathematicians, and signifying the mutual approach, tendency, or leaning of two lines or two planes towards each other, so as to form an angle.

INCLINED Plain, in *Mechanics*, one which forms an oblique angle with the horizon.

INCOGNITO is applied to a person who is in any place where he would not be known; but more particularly to princes or great men who enter towns or walk the streets without their ordinary train, or the usual marks of their distinction and quality.

INCOMBUSTIBLE Cloth. See Mineralogy. On this Cronstedt observes, that the natural store of the asbesti is in proportion to their economical use, both being very inconsiderable. "It is an old tradition," says he, "that in former ages they made cloths of the fibrous asbesti, which is said to be composed of the word *byssus*; but it is not probable, since, if one may conclude from some trifles now made of it, as bags, ribbons, and other things, such a dress could neither have an agreeable appearance, nor be of any conveniency or advantage. It is more probable that the Scythians dressed their dead bodies which were to be burned, in a cloth manufactured of this stone; and this perhaps has occasioned the above fable." M. Magellan confirms this opinion of Cronstedt's, and informs us that some of the Romans also enclosed dead bodies in cloth of this kind.

Incombustible, something that cannot be burned or consumed by fire. See Asbestos.

INCOMMENSURABLE, in *Geometry*, is a term applied to homogeneous magnitudes which have no common measure, or whereof one cannot be denoted as either multiple, aliquot part, or aliquot parts, of the other, or whose ratio cannot be represented by numbers.

The great Στοιχειωτης of the ancients has not expressly called attention to this negative relation of magnitudes earlier than in the tenth book of his *Elements*; but he has kept it steadily in view in the preceding parts of the work. Hence he has two distinct treatises of proportion; the one of proportion in *magnitudes*, the other of proportion in *numbers*.

In the second proposition of the tenth book it is shown, that if from the greater of two magnitudes we take the less, or the highest multiple of the less which it contains, then take from the less the remainder, or the highest multiple of the remainder which is contained in it, and so on continually; whenever this process becomes interminable, the magnitudes have no common measure.

The simplest instance of this interminable process to which we can refer, is in the case of a straight line and the greater segment of the same divided in extreme and mean ratio. For, by proposition 5, book xiii. it appears, that when the greater segment is taken from the whole, the remainder (that is, the less segment) has exactly the same relation to this greater segment which the greater has to the whole, and so on for ever.

If we begin a similar process with the diagonal and side of a square, at the end of every two operations the two lines with which we have to proceed have the same *relative* magnitude as the two with which we began; and thus we should never come to an end. If, therefore, the side of a square be one foot, we cannot possibly express the diagonal in feet or parts of a foot.

In fact, although, in ultimate practice, every quantity with which the mathematician has to deal is represented by numbers, whole or fractional, the cases where this representation is not metaphysically accurate are far more numerous than where it is perfect.

Take, for instance, the vulgar logarithms of the natural numbers. Let $\frac{p}{q}$ be the logarithm of the number N (where p, q, and the other general characters which we shall use, denote integer numbers). Then $N = 10^{\frac{p}{q}}$, whence $N^q = 10^p = 2^p \times 5^p$. And, since the q power of N contains no prime factors but 2 and 5, N itself can contain no other. Let $N = 2^r \times 5^s$. We have now $2^{qr} \times 5^{qs} = 2^p \times 5^p$; so that qr and qs being each equal to p, we have $\frac{p}{q} = r$, and $N = 10^r$. Thus $\frac{p}{q}$ is necessarily integer, consequently not one logarithm of the series can be properly a fraction; and those which are integer succeed only at intervals, of which each is ten times as great as the preceding.

We have said that the impossibility of reducing the relation of concrete magnitudes to that of numbers, in an infinity of cases, has caused Euclid to form two distinct treatises of proportion. And it is easy to see by what considerations he has passed from the simpler to the more complex, though this last has priority in the order of the *Elements*.

Two numbers are called proportional to two other, or "the first is said to have to the second the same ratio which the third has to the fourth, when the first is the same multiple (aliquot) part or parts of the second which the third is of the fourth." But we have seen that there may be *magnitudes* of the same kind, whereof one is neither multiple, part, nor parts of another; in other words, that have no common measure, no numerical ratio. Yet we may conceive two such magnitudes to be related to each other κατα πηλικοτητα, exactly like other two.

If D and S be the diagonal and side of a square; and Δ and Σ the diagonal and side of another square; and if S and Σ be divided into the same number of equal parts, however great the number and small the parts, we may conceive and easily prove, that whenever D is greater than m of the parts of S, but less than $m + 1$, Δ is also greater than m of the parts of Σ, but less than $m + 1$. So that, amongst incommensurable magnitudes, the first might be said to have the same ratio to the second which the third has to the fourth, when, "according as the first is greater or less than any multiple, part, or parts whatsoever of the second, the third is greater or less than the same multiple, part, or parts of the fourth." And both commensurable and incommensurable magnitudes might be brought under the following definition: "The first of four magnitudes has the same ratio to the second which the third has to the fourth, when, according as the first is greater than any multiple, part, or parts whatsoever of the second, equal to it, or less, the third is greater than the same multiple, part, or parts of the fourth, equal to it, or less."

Thus, if $\frac{n}{m}$B signify n of the magnitudes, of which B contains m, we might say, A has the same ratio to B which C has to D, if, according as A is greater than $\frac{n}{m}$B, equal to it, or less, C is greater than $\frac{n}{m}$D, equal to it, or less; m and n being not particular numbers, but any whatsoever. But if $A = \frac{n}{m}B$, we have $mA = nB$; and thence, according as A is greater than $\frac{n}{m}$B, equal to it, or less, we have mA greater than nB, equal to it, or less; and similarly, mC greater than nD, equal to it, or less. Thus we are brought to Euclid's definition (book v. def. 5), *Εν τῷ αὐτῳ λόγῳ μεγέθη λέγεται εἶναι, πρῶτον πρὸς δεύτερον καὶ τρίτον πρὸς τέταρτον· ὅταν τὰ τοῦ πρώτου καί τριτου ἰσάκις πολλαπλάσια τῶν τοῦ δέυτέρου καὶ τετάρτου ἰσάκις πολλαπλασίων, καθ' ὁποιονοῦν πολλαπλασιασμὸν, ἑκατέρου ἢ ἅμα ἐλλείπη, ἢ ἅμα ἴσα ᾖ, ἢ ἅμα ὑπερεχῃ ληφθέντα κατάλληλα.*

On the foundation of this definition he has constructed, in his sixth book, what appears to us a far more elegant treatise than any by which modern writers of elements have endeavoured to supersede it. That he has been able to accomplish it logically, without even mentioning the existence of incommensurable magnitudes, is the best possible evidence of its perfection.

His tenth book has often been called a treatise of incommensurables, or of surds. Not that Euclid has any mode of expressing abstract surds; but he treats of lines and areas whose relation could not be signified arithmetically without surds. The extent of his doctrines on this subject, in more than a hundred propositions, only embraces relations expressed by square roots, and their union with integral or fractional numbers, including repeated extractions of square roots, so as to produce biquadratic roots, &c. *in infinitum.*

It is manifest that he knew what is expressed in the algebraic formula $\sqrt{A + B} = \sqrt{\{\frac{1}{2}(A + \sqrt{A^2 - B^2})\}} + \sqrt{\{\frac{1}{2}(A - \sqrt{A^2 - B^2})\}}$; or that, as the same may be expressed implicitly, "the square root of A + B is the sum of the square roots of the numbers whose sum is A and product $\frac{1}{4}B^2$;" which gives this geometrical proposition: "The straight line equal in power to the rectangle under a given line, and the sum of two unequal lines, is composed of two straight lines, which are severally equal in power to the rectangles under the given line and those segments of the greater of the unequal lines whose rectangle is a fourth of the square of the less." He discusses with equal fulness the propositions contained in the kindred formula $\sqrt{A - B} = \sqrt{\{\frac{1}{2}(A + \sqrt{A^2 - B^2})\}} - \sqrt{\{\frac{1}{2}(A - \sqrt{A^2 - B^2})\}}$.

This affords a clew to the design of the greater part of the book, and some of the most elegant constructions. In particular, we may discover, in an attentive consideration of these formulæ, the origin of those *hexads* of irrational lines, of which he has been obliged to distinguish some by long and rather uncouth names.

The tenth book of the *Elements* is amongst the very finest performances of antiquity, for subtilty, clearness, and elegance. (O. O. O.)

INCOMMENSURABLE *Numbers* are such as have no common divisor that will divide them both equally.

INCOMPATIBLE, that which cannot subsist with another without destroying it. Thus cold and heat are incompatible in the same subject, the stronger overcoming and expelling the weaker.

INCORPOREAL, spiritual, a thing or substance which has no body. Thus the soul of man is incorporeal, and may subsist independently of the body.

INCORRUPTIBLES, INCORRUPTIBILES, the name of a sect which sprung out of the Eutychians. Their distinguishing tenet was, that the body of Jesus Christ was incorruptible; by which they meant, that after the time in which he was formed in the womb of his mother, he was not susceptible of any change or alteration, not even of any natural and innocent passions or appetites, so that he ate without any occasion, before his death, as well as after his resurrection. And hence it was that they took their name.

INCUBUS, NIGHT-MARE, a disease consisting in an oppression of the chest, so very violent that the patient cannot speak, or even breathe. The word is derived from the Latin, *incubare*, to lie down on any thing and press it. The Greeks call it ἐφιαλτης, *saltator*, leaper, or one that rushes on a person.

In this disease the senses are not quite lost, but drowned and astonished, as are the understanding and imagination; so that the patient seems to think some huge weight thrown on, and ready to strangle him. Children are very liable to this distemper; and so are fat people, and men of much study and application of mind. It is a result of dyspepsia.

INCUMBENT, a clerk or minister who is resident on his benefice, and who is called *incumbent*, because he does, or at least ought to, bend his whole study to discharge the cure of his church.

INCURVATION of the *Rays of Light*, their bending out of a rectilinear course, occasioned by refraction. See OPTICS.

INDEFEASIBLE, a term in law for what cannot be defeated or made void; as an indefeasible estate of inheritance, an indefeasible right, and so on.

INDEMNITY, in *Law*, the saving one harmless; or a writing to secure one from all damage and danger that may ensue from any act.

INDENTURE, in *Law*, a writing which comprehends some contract between two at least, being indented at top, answerable to another part which has the same contents. See DEED.

INDEPENDENTS, a sect of Protestants, so called from their maintaining that each congregation of Christians, with its office-bearers, which meets in one house for public worship, is a complete church; has sufficient power to act and perform every thing relating to religious government within itself; and is in no respect whatever subject or accountable to other churches.

The Independents, like every other Christian sect, derive their origin from the practice of the apostles in planting the first churches; but they were unknown in modern times till they arose in England during the reign of Elizabeth. The hierarchy established by that princess in the churches of her dominions, the vestments worn by the clergy in the celebration of divine worship, the book of common prayer, and, above all, the sign of the cross used in the administration of baptism, were very offensive to many of her subjects, who during the persecution of the former reign had taken refuge amongst the Protestants of Germany and of Geneva. Those men thought that the church of England resembled, in too many particulars, the church of Rome, which they believed to be antichristian; and they called perpetually for a more thorough reformation and a purer worship. From this circumstance they were stigmatised by their adversaries with the general name of *Puritans*, as the followers of Novatian[1] had been in the ancient church. Elizabeth was not disposed to comply with their demands; and it is difficult to say what might have been the issue of the contest had the Puritans been united in sentiments, in views, and in measures. But the case was quite otherwise. That large body, composed of persons of different ranks, characters, opinions, and intentions, and unanimous in nothing but in their antipathy to the forms of doctrine and discipline which were established by law, was all of a sudden divided into a variety of sects. Of these the most famous was that which was formed about the year 1581, by Robert Brown; a man insinuating in his manners, but unsteady and inconsistent in his views and notions of men and things.

This innovator differed not in point of doctrine either from the church of England or from the rest of the Puritans; but he had formed notions, then new and singular, concerning the nature of the church, and the rules of ecclesiastical government. He was for dividing the whole body of the faithful into separate societies or congregations; and maintained, that such a number of persons as could be contained in an ordinary place of worship ought to be considered as a church, and enjoy all the rights and privileges that are competent to an ecclesiastical community. These small societies he pronounced independent *jure divino*, and entirely exempt from the jurisdiction of the bishops, in whose hands the court had placed the reins of spiritual government; and also from that of presbyteries and synods, which the Puritans regarded as the supreme visible sources of ecclesiastical authority. He also maintained that the power of governing each congregation resided in the people, and that each member had an equal share in this government, and an equal right to order matters for the good of the whole society. Hence all points both of doctrine and discipline were submitted to the discussion of the congregation, and whatever was supported by a majority of voices passed into a law. It was the congregation also that elected certain of the brethren to the office of pastors, to perform the duty of public instruction, and the several branches of divine worship; reserving, however, to themselves the power of dismissing these ministers, and reducing them to the condition of private members, whenever they should think such a change conducive to the spiritual advantage of the community. It is likewise to be observed, that the right of the pastors to preach was by no means of an exclusive nature, or peculiar to them alone; since any member who thought proper to exhort or to instruct the brethren was abundantly indulged in the liberty of "prophesying" to the whole assembly. Accordingly, when the ordinary teacher or pastor had finished his discourse, all the other brethren were permitted to communicate in public their sentiments and illustrations upon any useful or edifying subject.

The zeal with which Brown and his associates maintained and propagated these notions was ardent and active. He affirmed that all communion was to be broken off with those religious societies which were founded upon a different plan from his; and treated the church of England more especially as a spurious church, the ministers of which were unlawfully ordained, whilst her discipline was popish and antichristian, and her sacraments and institutions destitute of all efficacy and virtue. The sect of this innovator, not being able to endure the severe treatment which their own zeal had brought upon them from an administration which was not distinguished for its mildness and indulgence, retired into the Netherlands, and founded churches at Middleburg in Zealand, and at Amsterdam and Leyden in the province of Holland. But their establishments were neither solid nor lasting. Their founder returned into England, and having renounced his principles of separation, took orders in the established church, and obtained a benefice. The Puritan exiles, whom he thus abandoned, disagreed amongst themselves, and having split into parties, their affairs gradually declined. This engaged the wiser part of them to mitigate the severity of their founder's plan, and to soften the rigour of his uncharitable decisions.

The person who had the chief merit of bringing about this reformation was one of their pastors, called John Robinson, a man who possessed much of the solemn piety of the times, and no inconsiderable portion of learning. This well-meaning reformer, perceiving the defects which reigned in the discipline of Brown, and in the spirit and temper of his followers, employed the utmost zeal and diligence in correcting them, and in new-modelling the society in such a manner as to render it less odious to its adversaries, and less liable to the censure of those Christians who looked upon charity as the end of the commandments. Hitherto the sect had been called Brownists; but Robinson having, in his Apology, affirmed, "Cœtum quemlibet particularem, esse totam, integram, et perfectam ecclesiam ex suis partibus constantem immediate et *independenter* (quoad alias ecclesias) sub ipso Christo," the sect was henceforth called *Independents*, and the apologist was considered as its founder.

The Independents were much more commendable than the Brownists, whom they surpassed both in the moderation of their sentiments, and in the order of their discipline. They did not, like Brown, pour forth bitter and uncharitable invectives against the churches which were governed by rules entirely different from theirs, nor pronounce them on that account unworthy of the Christian name. On the contrary, though they considered their own form of ecclesiastical government as of divine institution, and as originally introduced by the authority of the apostles, nay, by the apostles themselves, they had yet candour and charity enough to acknowledge that true religion and solid piety might flourish in those communities which were under the jurisdiction of bishops or the government of synods and presbyteries. This is put beyond all doubt by Robinson himself, who expresses his own private sentiments and those of his community in the following clear and precise words: " Profitemur coram Deo et hominibus, adeo nobis convenire cum ecclesiis reformatis Belgicis in re religionis, ut omnibus et singulis earundem ecclesiarum fidei articulis, prout habentur in harmonia confessionum fidei, parati simus subscribere. Ecclesias reformatas pro veris et genuinis habemus, cum iisdem in

[1] The followers of Novatian were called *Puritans*, because they would not communicate with the Catholic church, under pretence that her communion was polluted by admitting those to the sacred mysteries who through infirmity had sacrificed to idols in times of persecution. These unhappy men were not received by the church till after a long course of penance. But the Novatians would not receive them at all, however long their penance, or however sincere their sorrow, for their sin. In other respects, the ancient Puritans were, like the English, orthodox in the faith, and irreproachable in their morals.

sacris Dei communionem profitemur, et, quantum in nobis est, colimus." They were also much more attentive than the Brownists in keeping on foot a regular ministry in their communities; for, whilst the latter allowed promiscuously all ranks and orders of men to teach in public, the Independents had, and still have, a certain number of ministers, chosen respectively by the congregations where they are fixed; nor is any person amongst them permitted to speak in public, before he has submitted to a proper examination of his capacity and talents, and been approved of by the heads of the congregation.

This religious society still subsists, and has produced divines as eminent for learning, piety, and virtue, as any church in Christendom. It is now distinguished from the other Protestant communities chiefly by the two following circumstances: 1. The Independents reject the use of all creeds and confessions drawn up by fallible men, requiring of their teachers no other test of orthodoxy than a declaration of their belief in the gospel of Jesus, and their adherence to the Scriptures as the sole standard of faith and practice. 2. They attribute no virtue whatever to the rite of ordination, upon which some other churches lay so much stress; for the Independents declare, that the qualifications which constitute a regular minister of the New Testament, are a firm belief in the gospel, a principle of sincere and unaffected piety, a competent stock of knowledge, a capacity for leading devotion and communicating instruction, a serious inclination to engage in the important employment of promoting the everlasting salvation of mankind, and ordinarily an invitation to the pastoral office from some particular society of Christians. Where these things concur, they consider a person as fitted and authorized for the discharge of every duty which belongs to the ministerial function; and they believe that the imposition of the hands of bishops or presbyters conveys to him no powers or prerogatives of which he was not before possessed. At the same time it is their custom to impose hands in ordaining pastors, as a token of recognition in a new relation.

When the reformers separated from the church of Rome, they drew up public confessions of faith, or articles of religion, to which they demanded subscription from their respective followers. Their purpose in this was to guard against dangerous heresies, to ascertain the meaning of scriptural language, and, we doubt not, to promote the unity of the spirit in the bond of peace. These were laudable ends; but of the means chosen for attaining them, the late Dr Taylor of Norwich, the glory of the Independent churches, and whose learning would have done honour to any church, expresses his opinion in the following indignant language: "How much soever the Christian world valueth these creeds and confessions, I confess, for my own part, that I have no opinion of them. But we are told that they were generally drawn up by the ablest divines. But what evidence is there of this? are divines in vogue and power commonly the most knowing and upright? But granting that the reformers were in those days the ablest divines; the ablest divines educated in popish schools, notwithstanding any pretended learning, might comparatively be very weak and defective in Scripture knowledge, which was a thing in a manner new to them. In times of great ignorance they might be men of eminence, and yet far short of being qualified to draw up and decide the true and precise rules of faith for all Christians. Yea, their very attempting to draw up, decide, and establish, such rules of faith, is an incontestable evidence of their surprising ignorance and weakness. How could they be able divines, when they imposed upon the consciences of Christians their own decisions concerning gospel-faith and doctrine? Was not this in fact to teach and constrain Christians to depart from the most fundamental principle of their religion, subjection and allegiance to Christ, the only teacher and lawgiver? But if they were able men, were they infallible? No; they publicly affirmed their own fallibility; and yet they acted as if they had been infallible, and could not be mistaken in prescribing faith and doctrine.

"But even if they were infallible, who gave them commission to do what the Spirit of God had done already? Could the first reformers hope to deliver the truths of religion more fully and more clearly than the Spirit of God? Had they found out more apt expressions than had occurred to the Holy Spirit? The Son of God 'spake not of himself; but as the Father said unto him, so he spake' (John, xii. 50). 'The Spirit of truth spake not of himself; but whatsoever he heard, that he spake' (John, xvi. 13). 'The things of God the apostles spake, not in the words which man's wisdom teacheth, but which the Holy Ghost teacheth' (1 Cor. ii. 13). If the Christian revelation was thus handed down to us from the Fountain of Light with so much care and exactness, both as to matter and words, by the Son of God, by the Spirit, and by the apostles, who were the ancient doctors and bishops? or who were the first reformers? or who were any synods or assemblies of divines, that they dared to model Christian faith into their own invented forms, and impose it upon the minds of men in their own devised terms and expressions?

"Has Christ given authority to all his ministers to the end of the world, to new-mould his doctrines by the rules of human learning whenever they think fit? or hath he delegated his power to any particular persons? Neither the one nor the other. His doctrines are not of such a ductile nature; but stand fixed, both as to matter and words, in the Scripture. And it is at any man's peril, who pretends to put them, as they are rules of faith, into any new dress or shape. I conclude, therefore, that the first reformers, and all councils, synods, and assemblies, who have met together to collect, determine, and decide, to prescribe and impose matters pertaining to Christian faith, have acted without any warrant from Christ, and therefore have invaded the prerogative of him who is the sole Prophet and Lawgiver to the church. Peace and unity, I know, is the pretended good design of those creeds and confessions. But as God never sanctified them for these ends, so all the world knows they have produced the contrary effect; discord, division, and the spilling of whole seas of Christian blood, for fourteen hundred years together."

Such sentiments as these are now maintained by Christians of various denominations; but they were first avowed by the Independents, to whom, therefore, the merit or demerit of bringing them to light properly belongs. Our readers will think differently of them according to their preconceived opinions; but it is not our province either to confirm or to refute them. They rise almost necessarily out of the independent scheme of congregational churches; and we could not suppress them without deviating from our fixed resolution of doing justice to all religious parties, as well those from whom we differ as those with whom we agree. It ought not, however, to be rashly concluded that the Independents of the present age, merely because they reject the use of all creeds of human composition, doubt or disbelieve the doctrines deemed orthodox in other churches. Their predecessors in the last century were thought to be more rigid Calvinists than the Presbyterians themselves; as many of those may likewise be who in the present century admit not the confessions and formulas of the Calvinistic churches. They acknowledge as divine truth every doctrine contained in the Scriptures, but they think that scriptural doctrines are most properly expressed in scriptural language; and the same spirit of religious liberty which makes them reject the authority of bishops and synods in matters of discipline, makes them reject the same authority in matters of faith. In either case, to call any man or body of men their masters, would, in their opinion, be a violation of the divine law, since " one is their master, even Christ, and they are all brethren."

In support of their scheme of congregational churches, they observe that the word ἐκκλησια, which we translate *church*, is always used in Scripture to signify either a *single congregation*, or the *place* where a single congregation meets. Thus that unlawful assembly at Ephesus brought together against Paul by the craftsmen is called ἐκκλησια, *a church* (Acts, xix. 32, 39, 41). The word, however, is generally applied to a more sacred use; but still it signifies either the *body* assembling, or the *place* in which it assembles. The whole body of the disciples at Corinth is called *the church*, and spoken of as coming together into *one place* (1 Cor. xiv. 23). The place into which they came together we find likewise called *a church*; " when ye come together in the *church*,—when ye come together into one place" (1 Cor. xi. 18, 20). Wherever there were more congregations than one, there were likewise more *churches* than one. Thus, " Let your women keep silence in the *churches*," ἐν ταις ἐκκλησιαις (1 Cor. xiv. 34). The whole nation of Israel is indeed called a *church*, but it was no more than a single congregation, for it had but one place of public worship, namely, first the tabernacle, and afterwards the temple. The catholic church of Christ, his holy nation and kingdom, is likewise a single congregation, having one place of worship, that is, heaven, where all the members assemble by faith and hold communion; and in which, when they shall all be fully gathered together, they will in fact be one glorious assembly. Accordingly we find it called " the general assembly and church of the first-born, whose names are written in heaven."

Besides these, the Independent can find no other description of a church in the New Testament; not a trace of a diocese or presbytery consisting of several congregations all subject to one jurisdiction. The number of disciples in Jerusalem was certainly great before they were dispersed by the persecution in which Paul bore so active a part. Yet they are never mentioned as forming distinct assemblies, but as one assembly meeting with its elders in one place; sometimes in the temple, sometimes in Solomon's porch, and sometimes in an upper room. After the dispersion, the disciples who fled from Jerusalem, as they could no longer assemble in one place, are never called a church by themselves, or one church, but the *churches* of Judæa, Samaria, and Galilee (Acts, ix. 31; Gal. i. 22). Hence the Independent concludes, that in Jerusalem the words *church* and *congregation* were of the same import; and if such was the case there, where the gospel was first preached, he thinks we may reasonably expect to find it so in other places. Thus, when Paul on his journey calls the elders of the church of Ephesus to Miletus, he speaks to them as the joint overseers of a single congregation: " Take heed to yourselves, and to all the flock over which the Holy Ghost hath made you overseers" (Acts, xx. 28). Had the church at Ephesus consisted of different congregations united under such a jurisdiction as that of a modern presbytery, it would have been natural to say, " Take heed to yourselves, and to the *flocks* over which the Holy Ghost hath made you overseers;" but this is a way of speaking of which the Independent finds no instance in the whole of the New Testament. The sacred writers, when speaking of all the Christians in a nation or province, never call them *the church* of such a nation or province, but *the churches* of Galatia (Gal. i. 2), *the churches* of Macedonia (2 Cor. viii. 1), *the churches* of Asia (1 Cor. xvi. 19). On the other hand, when speaking of the disciples in a city or town, who might ordinarily assemble in one place, they uniformly call them *a church*; as, the church of Antioch, the church at Corinth, the church of Ephesus, and the like.

In each of these churches or congregations there were bishops, sometimes called elders, and deacons; and in every church there seems to have been more than one elder, in some a great many, " who all laboured in word and doctrine." Thus we read (Acts, xiv. 23) of Paul and Barnabas ordaining elders (to be bishops and deacons) in every church; and (Acts, xx. 17) of a company of elders in the church of Ephesus, who were exhorted to " feed the flock, and to take heed to themselves and to all the flock over which the Holy Ghost had made them overseers." But of such elders as are to be found in modern presbyterian churches, who neither teach nor are fit to teach, the Independent finds no vestige in the Scriptures, nor in the earliest uninspired writers of the Christian church. The rule or government of this presbytery or eldership in a church is not their own, but Christ's. They are not lords over God's heritage, nor can they pretend to more power over the disciples than the apostles possessed. But when the administration of the apostles in the church of Jerusalem, and other churches where they acted as elders, is inquired into by an Independent, it does not appear to him that they did any thing of common concern to the church without the consent of the multitude; nay, it seems they thought it necessary to judge and determine in discipline in presence of the whole church (Acts, vi. 1–6, xv. 22; 1 Cor. v. 3, 4, 5). Excommunication and absolution were in the power of the church at Corinth, and not of the elders as distinguished from the congregation (1 Cor. v.; 2 Cor. ii.). The apostle indeed speaks of his delivering some unto Satan (1 Tim. i. 20). But it is by no means clear that he did it by himself, and not after the manner pointed at (1 Cor. v. 4, 5); even as it does not appear, from his saying, in one epistle, that the gift was given unto Timothy by the putting on of *his* hands, that this was not done in the *presbytery* of a church, as in the other epistle we find it actually was. The trying and judging of false apostles was a matter of the first importance; but it was done by the elders with the flock at Ephesus (Rev. ii. 2; Acts, xx. 28); and that whole flock did, in the days of Ignatius, all partake of the Lord's Supper, and pray together in one place.[1] Even the power of binding and loosing, or the power of the keys as it has been called, was by our Saviour conferred, not upon a particular order of disciples, but upon the church. " If thy brother shall trespass against thee, go and tell him his fault between thee and him alone; if he shall hear thee, thou hast gained thy brother. But if he will not hear thee, then take with thee one or two more, that in the mouth of

[1] The evidence upon which this is stated by Mr Glass, for the whole of this reasoning is extracted from his works, is probably the following passage in the epistle of Ignatius to the Ephesians: Ἐι γαρ ἑνος και δευτερου προσευχη, " For if the prayer of one or two be of such force as we are told, how much more prevalent must that be which is made by the bishop and the whole church? He, then, that does not come together into the *same place* with it, is proud, and hath condemned himself; for it is written, God resisteth the proud. Let us not therefore resist the bishop, that we may be the servants of God." The sentence, as it thus stands by itself, certainly countenances Mr Glass's scheme; but the reader who thinks any regard due to the testimony of Ignatius will do well to peruse the whole epistle as published by Vossius.

two or three witnesses every word may be established. And if he shall neglect to hear them, tell it unto the church; but if he neglect to hear the *church*, let him be unto thee as an heathen man and a publican. Verily I say unto you, whatsoever ye shall bind on earth shall be bound in heaven," &c. (St Matth. xviii. 15, 16, 17, 18.) It is not said, if he shall neglect to hear the one or two, tell it to the elders of the church; far less can it be meant that the offended person should tell the cause of his offence to all the disciples in a presbytery or diocese consisting of many congregations. But he is required to tell it to that particular church or congregation to which they both belong; and the sentence of that assembly, pronounced by its elders, is in a very solemn manner declared to be final, from which there lies no appeal to any jurisdiction on earth.

With respect to the constituting of elders in any church or congregation, the Independent reasons in the following manner. The officers of Christ's appointment are either ordinary and permanent in the church, or they were extraordinary and peculiar to the planting of Christianity. The extraordinary were those who were employed in laying the plan of the gospel churches, and in publishing the New Testament revelation. Such were the apostles, the chosen witnesses of our Saviour's resurrection; such were the prophets inspired by the Holy Ghost for explaining infallibly the Old Testament by the things written in the New; and such were the evangelists, the apostles' ministers. These can be succeeded by none in that which was peculiar to them, because their work was completed by themselves. But they are succeeded in all that was not peculiar to them by bishops and deacons, the only two ordinary and permanent orders of ministers in the church. We have already seen that it belongs to the office of the bishop to feed the flock of Christ. The only question to be settled, then, is, How men are ordinarily called to that office? for about the office of the deacon there is little or no dispute. No man now can pretend to be so called of God to the ministry of the word as the apostles and other inspired elders were, whom he chose to be the publishers of his revealed truth, and to whose mission he bore witness in an extraordinary manner. But what the apostles were to those who had the divine oracles from their mouths, that their writings are to us; and therefore as no man can lawfully pretend a call from God to make any addition to those writings, so neither can any man pretend to be lawfully called to the ministry of the word already written, but in the manner which that word directs. Now there is nothing of which the New Testament speaks more clearly than of the characters of those who should exercise the office of bishop in the church, and of the actual exercise of that office. The former are graphically drawn in the epistles to Timothy and Titus; and the latter is minutely described in St Paul's discourse to the Ephesian elders, in St Peter's exhortation to elders, and our Lord's commission to those ministers with whom he promised to be always present even unto the end of the world. It is not competent for any man or body of men to add to or take from the description of a gospel minister given in these places, so as to insist upon the necessity of any qualification which is not there mentioned, or to dispense with any qualification as needless which is there required. Neither has Jesus Christ, the only legislator to the church, given to any ministers or people any power or right whatsoever to call, send, elect, or ordain, to that office, any person who is not qualified according to the description given in his law; nor has he given any power or right to reject the least of them who are so qualified, and who desire the office of a bishop or elder. Let a man have hands laid upon him by such as could prove an uninterrupted descent by imposition of hands from the apostles; let him be set apart to that office by a company of ministers themselves, the most conformable to the Scripture character; and let him be chosen by the most holy people on earth; yet if he answer not the New Testament description of a minister, he is not called of God to that office, and is no minister of Christ, but is indeed running unsent. No form of ordination can pretend to such a clear foundation in the New Testament as the description of the persons who should be elders of the church; and the laying on of hands is of small importance in the mission of a minister of Christ; for now, when the power of miracles has ceased, it is obvious that such a rite, by whomsoever performed, can convey no powers, whether ordinary or extraordinary. Indeed it appears to have been sometimes used, even in the apostolic age, without any such intention. When St Paul and St Barnabas were separated to the particular employment of going out to the Gentiles, the prophets and teachers at Antioch "prayed and laid their hands on them." But did this ceremony confer upon the two apostles any new power or authority to act as ministers of Christ? Did the imposition of hands make those shining lights of the gospel one whit better qualified than they were before to convert and baptize the nations, to feed the flock of God, to teach, rebuke, or exhort, with all long-suffering and patience? It cannot be pretended that there was any special virtue in this ceremony. St Paul and St Barnabas had undoubtedly received the Holy Ghost before they came to Antioch; and as they were apostles, they were of course authorized to discharge all the functions of the inferior and ordinary ministers of the gospel. As in this instance, however, the imposition of hands appears to have been a mark of recognition of the parties as qualified for the work to which they were appointed, so Independents usually lay on the hands of the bishops with the same intent. In a word, whoever in his life and conversation is conformable to the character which the inspired writers give of a bishop, and is likewise qualified by his "mightiness in the Scripture" to discharge the duties of that office, is fully authorized to administer the sacraments of baptism and the Lord's Supper, to teach, exhort, and rebuke, with all long-suffering and doctrine, and has all the call and mission which the Lord now gives to any man; whilst he who wants the qualifications mentioned has not God's call, whatever he may have, nor any authority to preach the gospel of Christ, or to dispense the ordinances of his religion.

From this view of the Independent principles, which is faithfully taken from their own writers, it appears that, according to them, even the election of a congregation confers upon the man whom they may choose for their pastor no new powers, but only creates a new relation between him and a particular flock, giving him an exclusive right, either by himself or in conjunction with other pastors constituted in the same manner, to exercise among them that authority which he derives immediately from Christ, and which, in a greater or less degree, is possessed by every sincere Christian according to his gifts and abilities. Were the ministers of the gospel constituted in any other way than this; by imposition of hands, for instance, in succession from the apostles; the case of Christians would, in the opinion of the Independents, be extremely hard, and the ways of God scarcely equal. We are strictly commanded not to forsake the assembling of ourselves together, but to continue stedfast in the apostles' doctrine and fellowship, and in the breaking of bread, and in prayer. "But can any man," asks one of their advocates, "bring himself to believe, that what he is commanded to do in point of gratitude, what is made his own personal act, an act expressive of certain dutiful and pious affections, can possibly be restricted to the intermediate offices or instrumentality of others, who act by powers which he can neither give nor take away? To suppose a thing necessary to my happiness, which is not in my own power, or wholly depends upon the good pleasure of another, over whom I have no authority, and concerning whose intentions and dispositions I can have no security, is to suppose a constitution the most foolish and ill natured, utterly inconsistent with our ideas of a wise and good agent." Such are some of the principal arguments by which the Independents maintain the divine right of congregational churches. For many years the numbers of this denomination of Christians have been increasing, especially in England; and it is calculated that they have now nearly 1600 congregations in England and Wales. They have only about eighty in Scotland, and thirty in Ireland; but it is reckoned that they have nearly a thousand congregations in America.

Sir James Mackintosh, in his *Historical Fragment*, gives a short notice of this body. "They disclaimed the qualifications of 'national,' as repugnant to the nature of 'a church.' The religion of the Independents could not, without destroying its nature, be established by law. They never could aspire to more than religious liberty, and they accordingly have the honour to be the first, and long the only, Christian community who collectively adopted that sacred principle. It is true, that in the beginning they adopted the pernicious and inconsistent doctrine of limited toleration, excluding Catholics as idolators, and, in New England, where the great majority were of their persuasion, punishing even capitally dissenters from opinions which they accounted fundamental. But as intolerance could promote no interest of theirs, real or imaginary, their true principles finally worked out the stain of these dishonourable exceptions. The government of Cromwell, more influenced by them than by any other persuasion, made as near approaches to general toleration as public prejudice would endure; and Sir Harry Vane, an Independent, was probably the first who laid down, with perfect precision, the inviolable rights of conscience, and the exemption of religion from all civil authority."[1]

INDERABIA, or ANDERABIA, a small island near the mouth of the Persian Gulf. It is separated from the mainland by a strait about three miles in length, three in breadth, and free from danger. It is a low, level, and narrow island, about three miles in length. Ships running for shelter under this island must not come within a mile of its south end, until a remarkable tree, which will be distinguished by itself, bears west-north-west. Lat. 26. 40. N.

INDETERMINATE, in general, an appellation given to whatever is not certain, fixed, and limited; in which sense it is the same with *indefinite*.

INDEX, in *Anatomy*, denotes the fore finger. It is so called from *indico*, I point or direct, because that finger is generally so used; and hence also the extensor indicis is called *indicator*.

INDEX, in *Arithmetic* and *Algebra*, shows to what power any quantity is involved, and is otherwise called its *exponent*. See ALGEBRA.

INDEX of a Book, is that part annexed to a book, referring to the particular matter or passages therein contained.

INDEX of a Globe, is a little style fitted on to the north pole, and turning round with it, pointing to certain divisions in the hour-circle. It is sometimes also called *gnomon*. See GLOBE.

INDEX EXPURGATORIUS, a catalogue of prohibited books at Rome.

INDIA. The general name of India has always had a very wide and rather indefinite application, both in ancient and modern times. It has been generally used to designate all those vast regions of the Asiatic continent which lie to the eastward of the Indus, which were accordingly distinguished by the ancients into two great divisions, namely, *India intra Gangem*, and *India extra Gangem*. The meaning of the name, which has long been a source of perplexity to the learned, has never been clearly ascertained. It is supposed to be of Persian origin, from the word Hind, or Heando, the term in the more ancient languages of Persia, which has been employed by the Greeks and Romans, and from them made its way into the modern languages of Europe. The progress of ancient discovery in India has been already narrated in our account both of Asia and Hindustan. Prior to the expedition of Alexander, all the knowledge which the Greeks possessed of India was derived from the report of the Persians. The geographical writers of ancient times, Eratosthenes, Strabo, and Pliny, procured more correct information from Alexander's officers; and in later times the ancients extended their knowledge of India by means of commerce. The general notion of the boundaries of India within the Ganges appears to have been correct. On the north they stated the boundary to be a range of mountains, the modern Himalaya, which they considered to be the extremity of the range of Mount Taurus, and which were named Paropamesus by the natives, or the mountains of Emodus and Imaus. The Indus was pointed out as the western boundary; and in later times, when the knowledge of Indian geography was extended, the Ganges was considered the boundary on the east, and the ocean on the south. Of the form and limits of this extensive region, known under the general appellation of India, the ancients entertained very erroneous notions. Of the country that lay between the Indus and the Ganges they had begun to acquire from travellers more accurate information; but their accounts respecting Southern India was still imperfect. The different geographical writers enumerate many distinct tribes who were scattered over the country between the Indus and the Ganges; but they seem not to have had sufficient information for such a classification of the inhabitants; and little instruction is conveyed concerning India in such a list of uncouth names. Of India beyond the Ganges the ancients are still more imperfectly informed, nor do they seem to have affixed any limits to its extension eastward.

This term of India has been applied with great latitude by modern geographers, not only to Hindustan, but to the countries eastward as far as China, including Arracan, Ava, Cassay, Cachar, Pegu, Tongho, Martaban, Junkseylon, Tavay, Tenassarim, Lowashan, Yemshar, and all the other districts really or nominally subordinate to the Burman empire; also Siam, Malacca, Cambodia, Siampa, Laon, Cochin China, and Tunquin. It includes, in short, all those extensive countries that lie between the Indus on the west and China on the east, and that are bounded on the north by Bukharia and Thibet, on the south by the Indian Ocean and the Bay of Bengal, and on the north-east by the Chinese Sea. A particular description of Hindustan, and of all these other countries, will be found under their respective titles, to which therefore the reader is referred.

INDIA Company. See COMPANY.

INDIA Rubber. See CAOUTCHOUC.

INDIAN, in a general sense, denotes any thing belonging to the Indies, East or West.

INDIAN ISLAND lies on the coast of New Zealand, on the south point of Dusky Bay, and is about four miles in circumference.

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[1] *View of the Reign of James II.* p. 166.

INDIANA, one of the United States of North America, is bounded on the north by Lake Michigan, and the territory of the same name; on the south by Kentucky; on the east by Ohio; and on the west by Illinois. It extends from Lat. 37° 50′ to Lat. 41° 45′ north; and from Long. 84° 45′ to Long. 88° west; being 270 miles in length, 220 in breadth, and containing a superficies of 36,000 square miles. Although this state is more hilly than Illinois, it contains no mountains of any great height. The southern front has the usual belt of river hills, bluffs, and knobs, known by the name of Ohio Hills, which often rise immediately from the waters of the Ohio, in forms of picturesque grandeur and beauty, and sometimes retreat from it to a considerable distance, leaving between the river and their base, a bottom of two or three miles in extent. A range of hills, called the Knobs, stretching from the Ohio to White River of the Wabash, forms the limits of the table lands which separate the waters of the Ohio from those of White River. North of the Wabash, the hills which bear the same name, are precipitous, and the country is to a considerable extent broken and rugged. Large portions of the state may be pronounced hilly, but three-fifths of it at least consist of vast tracts of level country. The wide extent of land watered by the White River is for the most part level. The prairies, so characteristic of the New World, have the usual distinction of high and low, swampy and alluvial. They differ in no respect from those of Illinois, being alike rich, level, and prolific of grass and flowering plants. Those which are situated along the course of the Wabash have been particularly admired for their beauty and fertility. Many of the prairies are long and narrow, some of them, like those of Illinois, are larger than can be taken in at once by the eye, and others are only large enough for a few farms. They are usually bounded by dense forests, and are not unfrequently adorned with copses of small trees. In spring and summer, the luxuriant growth of grass and fragrant flowers, with which they are covered, rises to from six to eight feet in height. For a considerable extent on the northern frontier of the state, between the Wabash and Lake Michigan, the country is for the most part an extended plain, alternately prairie and woodland, diversified by swamps, and by small lakes and ponds. No part of the western world presents larger tracts of rich land, than that portion of White River country, of which Indianopolis, the capital of the state, is the centre. The river or low prairies are levels destitute of timber, and are said to exhibit vestiges of former cultivation. The high or upland prairies are elevated from thirty to one hundred feet above the others, and are far more numerous and extensive. The ordinary depth of the vegetable soil is from two to five feet, but in some places it has been found to extend twenty-two feet downwards. The forest trees, shrubs, plants, and grasses, do not materially differ from those of Illinois, but there is a much greater proportion of beech timber. The principal productions of the state are wheat, Indian corn, rye, oats, barley, buckwheat, and potatoes. There are some prairies and "bottoms" too rich for growing wheat, until the natural wild luxuriance of the soil has been somewhat reduced by cropping. Upland rice has been cultivated with success, and some of the more sheltered and warm valleys have, in favourable years, yielded considerable crops of cotton. This state is exceedingly well adapted for rearing the finest fruits, and fruit-bearing shrubs. There are in many places abundance of wild berries; and on some of the prairies the strawberries are large and fine. It is stated that in the low prairies in the northern parts, whole tracts are covered with the beautiful fowl meadow-grass, the *Poa pratensis* of the north. But wherever the natural prairie grass has been destroyed by being pastured by domestic animals, it is succeeded by the blue grass of the western country, which furnishes not only a beautiful sward, but covers the ground with a carpeting of rich fodder, not unlike the second crop, which is cut in the northern states as the most valuable kind of hay. For all the objects of farming, and raising of grain, hemp, tobacco, and other necessaries, and the rearing of cattle, sheep, swine, horses, as well as other animals, the emigrant could not find a more advantageous country than Indiana. In the rich "bottoms" of the southern parts, the reed cane, and uncommonly large ginseng, are abundant.

This state possesses a great number of rivers and springs, very happily distributed over the country. Their origin is generally to be traced to swamps or lakes, and the surrounding districts are too low and wet for cultivation. The southern extremity is well watered throughout its whole length by the Ohio; and into this noble stream a considerable number of tributaries flow. But the chief river of Indiana is the Wabash, which, after Tennessee, is one of the most considerable tributaries of the Ohio. It traverses the central parts of the state, and, by its extensive branches, irrigates a great portion thereof. White River enters the Wabash from the eastern side, sixteen miles below Vincennes. It is the most considerable tributary of the Wabash, and one of the most important rivers of the state. It waters a vast tract of very fertile country, in a lateral direction to the main stream. It receives a great number of considerable tributaries from the west, and several smaller ones enter it from the eastern side. White Water, which rises in Ohio, waters a large portion of fertile country. The northern frontier of the state, bordering on the territory of Michigan, and the lake of the same name, is watered copiously by rivers which discharge their waters into that lake and Lake Erie. The courses of these streams are generally short, but they carry along large volumes of water. Most of them have their origin in lakes and ponds, of which above one hundred exist along the northern frontier. Many of them have the peculiar character of the waters in this region; that is, they are situated on an elevated plateau, from one extremity of which the waters are discharged into the lakes, and from the other into the waters of the Mississippi. The amount of inland navigation of Indiana is great, although it is not equal to that of Illinois. It possesses the whole extent of the Wabash and White River, with its numerous branches navigable by fly-boats. A navigable canal now connects the White Water with the Ohio, at Cincinnati; others are either completed, in progress, or in contemplation; and, as the wealth and commerce of the state increase, it will emulate the enterprise, the canals, and the great public works of the sister state of Ohio. The whole recent extent of inland navigation which it enjoys may be fairly computed at 5000 miles. A great national road, passing from east to west through the state, is in progress, and a rail-road, from Ohio to Lake Michigan, has been projected.

The climate of Indiana resembles that of Illinois, and the other neighbouring states. That part of it which is contiguous to Lake Michigan is subject to copious rains, and, being otherwise low and marshy, much of the land is unfit for cultivation. For a considerable distance from the lake, sand heaps covered with a few stunted junipers, and swept by the gales of the lake, give little promise of a fine country or propitious climate. But beyond the point to which the breezes of the lake extend, the climate is mild and temperate. The state in general is rather less exposed than Illinois to the extremes of heat and cold. The climate is in general healthy; indeed, the astonishing increase of the population within a few years, affords a proof of this. The higher regions are, of course, more so than those which are low and are swampy. The winters are mild, compared with those of New England or Pennsylvania. Winter commences in its severity about Christmas, but seldom lasts longer than six weeks. During this period, the rivers which have not very rapid currents are frozen; although

Indiana.

winters occur in which the Wabash cannot be crossed upon the ice. Snow does not fall to any great depth; in the middle and southern parts rarely more than six inches. Peach trees are generally in blossom early in March, and the foliage of the forest assumes its green tint in the middle of April.

The interior and northern parts of this state are abundantly stocked with game. Bears, and especially deer, are common. Wild turkeys abound, and prairie hens, partridges, and grouse are seen in countless numbers. The streams, especially those which communicate with Lake Michigan, are stocked with fish of various kinds and the best qualities. Venomous reptiles are sometimes met with, most commonly in the vicinity of ledges of rocks. The rattlesnake and the copper-head are the most numerous and dangerous.

There are salt springs in different parts of the state, but they do not appear to be wrought to any extent. Stone-coal of the best quality is found in various places. Native copper has been discovered in small masses, in the northern parts of the state. Iron-ore is also found in some places. But in general it is too level a country to afford many minerals.

Like Alabama and Tennessee, this state abounds with subterranean wonders, such as caves. Many of these have been explored, and some of them have been described. One of them is generally known in the western country by the name of the *Epsom Salts Cave*. It is situated at a short distance from Jeffersonville. When first discovered, the salts were represented as being some inches deep on the floor. The interior of this cave possesses the usual domes and chambers of extensive caverns, through which the visitant gropes his way inwards for a mile and a quarter, till he reaches the Pillar, which is a splendid column, 15 feet in diameter, and 25 feet in height, regularly reeded from top to bottom. Near it are smaller pillars having the same appearance. The salt in question is sometimes found in lumps, varying from one to ten pounds. The floor and walls are covered with it in the form of frost-work, which, when removed, is speedily reproduced. The earth yields from four to twenty pounds to the bushel, and the product is said to be of the best quality. Nitre is also found in the cave in great abundance; and likewise sulphate of lime, or plaster of Paris.

With regard to the towns of this state, to enumerate all that have attained some degree of importance, would only be to present a barren catalogue of names. We shall shortly describe the principal of these, beginning with Lawrenceburgh, on the south-eastern angle of the state. This town, the seat of justice for the county of Dearborn, stands on the northern bank of the Ohio, twenty-three miles below Cincinnati, and two miles below the Big Miami, the eastern limit of the state. It is situated in the centre of a rich "bottom," and since its commencement has made very rapid progress. Its position in relation to the river, the rich adjacent country, and the Big Miami, is highly eligible. Many of the houses are handsome, and have a fine appearance from the river. There are a number of respectable manufactories, and every thing promises a large and populous town at no distant date. At present the inhabitants are above 1000 in number. Vevay, the seat of justice for Switzerland county, is situated forty-five miles below Cincinnati. It contains between two and three hundred dwelling-houses, a court-house, jail, academy, a printing-office, from which issues a weekly journal, and a branch of the bank of Indiana, besides other public buildings. In the neighbourhood of this town there is the largest vineyard in the United States. Vines have been cultivated to a great extent, and with a success unrivalled in the western world. The inhabitants are chiefly emigrants from Switzerland, who brought with them, from the vine-clad mountains of their native country, those simple manners, and those habits of industry and perseverance, for which that people are distinguished. They are constantly making improvements in the cultivation of the grape, and the wine made from it is of a very superior quality. The Swiss have created some manufactures peculiar to themselves, particularly that of straw-hats. Madison, a populous and thriving town, situated on the Ohio, and nearly equidistant from Louisville and Cincinnati, was commenced in the year 1811. Its position on the Ohio is peculiarly favourable, as it is the point of the river nearest to Indianapolis, and the landing-place for the imports from the Ohio to a number of the newly-settled and thriving counties. Besides churches and public buildings, it has nearly thirty stores of dry-goods, many of which transact extensive business. Large exports of the produce of the country are made here, and the town is particularly noted for the quantity of pork which is barrelled in it. It contains above 2000 inhabitants. Jeffersonville, which is situated just above the Falls of Ohio, is a considerable and handsome village. Four miles and a half below it stands New Albany, the seat of justice for Floyd county. It has a convenient yard for building steam-boats, and is a thriving and busy village, containing about 2000 inhabitants. Passing over some places of minor note, we come to Corydon, the seat of justice for the county of Harrison, and once the political metropolis of the state. It is situated in the forks of Indian Creek, about twenty-three miles from Jeffersonville, and thirteen miles from Ohio. Salem, which is situated on a small branch of Blue River, thirty-four miles north of Corydon, is a flourishing country town, containing above one hundred houses. Vincennes, one of the oldest places in the western world, was settled by French emigrants in the beginning of the last century. It is situated 150 miles above the mouth of the Wabash, and fifty-four from the nearest point of the Ohio. It contains above 300 dwelling-houses, a number of public buildings, and about 1500 inhabitants. Harmony lies fifty-four miles below Vincennes, and sixteen miles from the nearest point of the Ohio, on a rich and heavily-wooded plateau, or second "bottom." It is situated on high ground, is healthy, has a fertile soil, and is in the vicinity of small and rich prairies. It was first settled in 1814 by a religious sect of Germans, denominated Harmonites. They settled first in Pennsylvania, whence they moved in a body, amounting to 800 persons, to this place. Like the primitive Christians, they held their property in common, and their lands were laid off with all the regularity which the compass and square could give to them. For some time they laboured industriously and in perfect peace, but their eyes ultimately began to revert to the temperate climate and the rich savannahs where they had first settled. Whilst under the influence of these yearnings, the leader of a new sect appeared amongst them. This was Robert Owen of New Lanark, in Scotland, the expounder of a new social system. He purchased a large portion of territory, together with a village, and in a short period from seven to eight hundred persons were admitted members of the new establishment. For some time matters seemed to promise fair for the success of the experiment, but it finally shared the fate of the former settlement, as well as that of every other by which theorists would attempt to divert the stream of things from its natural course. The social system is now abandoned. Brookville, which is situated in the Forks of the White River, contains about 100 houses. The surrounding country is well timbered and watered. The soil is rich and productive, and has acquired celebrity on account of the excellence of the tobacco which it produces. Harrison is situated on the north bank of White River, eight miles from its mouth, and eighteen north-east of Brookville, in the centre of an excellent tract of land. The village is divided between the jurisdiction of Indiana and Ohio. In the rich and extensive "bottoms" which surround this place are found great numbers of Indian mounds, containing human bones, axes, vases, and various other implements of war and domestic utensils. Indianapolis, the seat of the government of the state, is situated on the western bank of White River, nearly in the centre of the state, and at a point accessible by steam-boats, in the ordinary state of the Wabash. It is surrounded by one of the most extensive and fertile tracts in North America, and it is being settled with unexampled rapidity. A few years have been sufficient to convert it from a deep and almost impenetrable forest into a populous town and a cultivated country. There are several excellent public buildings, and many comfortable dwelling-houses. In course of time Indianapolis will no doubt become one of the largest towns between Cincinnati and the Mississippi.

This state was admitted into the Union in 1816, when its present constitution was formed. It does not essentially differ from those of the other western states. A governor and lieutenant-governor are chosen by the people triennially. There is a general assembly, consisting of a senate, the members of which are chosen for periods of three years, a third part being elected annually; and of a house of representatives, the members of which are elected annually. The number of representatives may be increased to onc hundred, and of senators to fifty; but at present they do not amount to much more than the half of these numbers. The judges of the supreme court are appointed by the governor, with the consent of the senate; the presidents of the circuit courts by the legislature; and the associate judges are elected by the people. A thirty-sixth part of the land in each township is reserved, by a compact between the state and the rest of the Union, for the support of education; and reservations of land have been made for the support of a college, which is established at Bloomington. Very considerable interest is taken in the cause of education throughout this state. Schools arc established in all the considerable towns and villages, and many of them have a reading-room and library. An historical society has been formed, the object of which is to collect and preserve the antiquities of the state.

This part of the country was first colonized by some French soldiers of Louis XIV., who settled at Vincennes as early as 1702. For nearly a century this solitary colony remained isolated from the rest of mankind, and even retrograded towards the state of the savages who surrounded it, and with whom the colonists intermarried. During the revolution, they manifested a disposition so favourable to the republic, that the general government ceded a tract of land to them at the termination of the war. The savages, however, continued to harass them until the peace, which was restored by the treaty of Greenville. The greater part of the territory was still claimed by the natural heirs of the soil; but in 1811, in consequence of their depredations and murders, a military force was sent against them, and they were defeated in the bloody battle of Tippecause. Since the peace they have been quiet, and have ceded the greater part of their lands to the United States. The remnants of several tribes still remain, and possess either lands or annuities from government. Their numbers may amount to about 5000.

The increase of population in this state has been unusually rapid. In 1820, the inhabitants amounted to 147,000, and the census of 1830 states them to be 344,000, but this number include only persons resident in the state. The revenue for 1831 was 103,000 dollars, and the expenditure 37,765 dollars. (R. R. R.)

INDICATION, in *Physic*, whatever serves to direct the physician how to act.

INDICATIVE, in *Grammar*, the first mood or mode of the verb, by which we simply affirm, deny, or ask something, as, *amant*, they love; *non amant*, they do not love; *amant ne?* do they love? See GRAMMAR.

INDICTION, in *Chronology*, a cycle of fifteen years.

INDICTMENT, in *Law*, one of the modes of prosecuting an offender. In English law, it is a written accusation of one or more persons of a crime or misdemeanor, preferred to, and presented upon oath by, a grand jury. In Scotch Law, it is the name of the summons, or libel, upon which criminals are cited to take their trial before the High Court of Justiciary, and is drawn in the form of a syllogism.

INDIGENOUS, from *indigena*, denotes a native of a country, or that which was originally born or produced in the country where it is found. In this sense, particular species of animals and plants are said to be *indigenous* to the country where they are native; in opposition to EXOTIC.

INDIGESTION, a crudity or want of due coction of the food in thc stomach.

INDIGETES, a name which the ancients applied to some of their gods.

There are various opinions concerning the origin and signification of this word. Some pretend that it was given to the gods in general; others, that it was only applied to the demigods, or great men deified. Some say that it was given to such gods as were originally of the country, or rather such as were the gods of the country which bore this name; whilst others hold that it was ascribed to such gods as were patrons and protectors of particular cities; and others again contend that *indigetes* was derived from *inde genitus* or *in loco degens*, or from *inde* and *ago*, for *dego*, I live, I inhabit; an opinion which seems to be the most probable of all.

In effect it appears, that these *indigetes* were also called *local gods* (*dii locales*), or *topical gods*, which is the same thing; that the *indigetes* were ordinarily men deified, who indeed were in effect local gods, being esteemed the protectors of those places where they were deified; that Virgil joins *patrii* with *indigetes*, as being the same thing (*Georg.* i. ver. 498.), thus *dii patrii, indigetes*; and that the gods to whom the Romans gave the name of *indigetes* were, Faunus, Vesta, Æneas, Romulus, all the gods of Italy, Minerva at Athens, and Dido at Carthage. It is truc, we meet with Jupiter *indiges*; but that Jupiter *indiges* is Æneas, not the great Jupiter, we may see in Livy (lib. i. cap. 3.); and in this last sense Servius assures us that *indiges* comes from the Latin *in diis ago*, I am amongst the gods.

Amongst these *indigetes* gods, there was none more celebrated, or more extensively worshipped, than Hercules.

INDIGO, a dye prepared from the leaves and small branches of the *Indigofera tinctoria*.

This plant requires a smooth rich soil, well tilled, and not too dry. The seed of it, which, in figure and colour, resembles gunpowder, is sown in little furrows that are about the breadth of thc hoe, two or three inches deep, at the distance of a foot from each other, and in as straight a line as possible. Continual attention is required to pluck up the weeds, which would soon choke the plant. Though it may be sown in all seasons, the spring is commonly preferred. Moisture causes this plant to shoot above the surface in three or four days. It is ripe at the end of two months. When it begins to flower, it is cut with pruning-knives; and cut again at the end of every six weeks, if the weather happen to be a little rainy. It lasts about two years, after which term it degenerates, and is then plucked up, and planted afresh. As this plant soon exhausts the soil, because it does not absorb a sufficient quantity of air and dew to moisten the earth, it is of advantage to the planter to have a vast space which may remain covered with trees, till it become necessary to fell them in order to make room for the indigo.

Indigo is distinguished into two kinds; the *true* and the *bastard*. Though the first is sold at a higher price on account of its superiority, it is usually advantageous to cultivate the other, because it is heavier. The first will grow in many different soils; the second succeeds best in those which are most exposed to the rain. Both are liable to great accidents. Sometimes the plant becomes dry, and is destroyed by an insect frequently found on it; at other times, the leaves, which are the valuable part of the plant, are devoured in the space of twenty-four hours by caterpillars. This last misfortune, which is but too common, has given occasion to the saying, that the planters of indigo go to bed rich, and rise in the morning totally ruined.

This production ought to be gathered in with great precaution, for fear of making the farina that lies on the leaves, and is very valuable, fall off by shaking it. When gathered, it is thrown into the steeping-vat, which is a large tub filled with water. Here it undergoes a fermentation, which in twenty-four hours at furthest is completed. A cock is then turned to let the water run into the second tub, called the *mortar* or *pounding-tub*. The steeping-vat is then cleaned out, that fresh plants may be thrown in; and thus the work is continued without interruption.

The water which has run into the pounding-tub is found impregnated with a very subtile earth, which alone constitutes the dregs or blue substance that is the object of this process, and which must be separated from the useless salt of the plant, because this makes the dregs swim on the surface. To effect this, the water is forcibly agitated with wooden buckets, which are full of holes and fixed to a long handle. This part of the process requires the greatest precautions. If the agitation be discontinued too soon, the part that is used in dyeing, not being sufficiently separated from the salt, would be lost. If, on the other hand, the dye were to be agitated too long after the complete separation, the parts would be brought together again, and form a new combination; and the salt reacting on the dregs would excite a second fermentation, that would alter the dye, spoil its colour, and make what is called *burnt indigo*. These accidents are prevented by a close attention to the least alterations which the dye undergoes, and by the precaution which the workmen take to draw out a little of it from time to time in a clean vessel. When they perceive that the coloured particles collect by separating from the rest of the liquor, they leave off shaking the buckets, in order to allow time to the blue dregs to precipitate to the bottom of the tub, where they are left to settle till the water is quite clear. Holes made in the tub, at different heights, are then opened one after another, and the useless water is let out.

The blue dregs remaining at the bottom having acquired the consistence of a thick muddy liquid, cocks are then opened, which draw it off into the settler. After it is still more cleared of much superfluous water in this third and last tub, it is drained into sacks, from which, when water no longer filters through the cloth, this matter, now become of a thicker consistence, is put into chests, where it entirely loses its moisture. At the end of three months the indigo is fit for sale.

It is used, in washing, to give a bluish colour to linen; painters also employ it in their water colours; and dyers cannot make fine blue without indigo. The ancients procured it from the East Indies; in modern times, it has been transplanted into America.

INDIVIDUAL, a particular being of any species, or that which cannot be divided into two or more beings equal or alike.

The usual division in logic is made into *genera;* those *genera* into *species;* and those *species* into *individuals.*

INDIVISIBLE, amongst metaphysicians. A thing is said to be absolutely *indivisible,* that is, a simple being, when it consists of no parts into which it can be divided. Thus, God is *indivisible* in all respects; as is also the human mind, not having extension, nor other properties of body.

INDIVISIBLES, in *Geometry*, the elements or principles into which any body or figure may be ultimately resolved, which elements are supposed to be infinitely small. Thus, a line may be said to consist of points, a surface of parallel lines, and a solid of parallel and similar surfaces.

INDORSEMENT, in *Law*, any thing written on the back of a deed; as a receipt for money received.

There is likewise an *indorsement*, by way of assignment, on bills of exchange and notes of hand; which may be done by merely writing a person's name on the back of the instrument.

INDRE, a department of France, formed out of a part of the ancient Touraine, and a portion of the province of La Marche. It is an inland division, surrounded on every side by other departments of the kingdom. The extent is 2925 square miles, or, according to the *Royal Almanac*, 702,240 hectares, of which 441,383 are under the plough, 14,025 are vineyards, 36,696 pastures, 10,409 commons, 104,568 waste heaths, 57,343 woods and forests, 5059 gardens, and the remainder consists of the sites of cities, towns, and villages, and of roads, rivers, and canals. It is divided into 4 arrondissements, and these are subdivided into 23 cantons, and 275 communes, with a population of 207,721 individuals, all professing the Catholic religion, and having 166 churches. It is a level district, with but few hills, and only such valleys as receive the several streams which run through them. On the southern boundary there is a range of hills, not lofty, composed of granite and slate, but they rather belong to the department of the Cher. The department is watered by no less than 15 rivers, and 100 subsidiary brooks. The principal streams are the Creuse, the Indre, the Fouson, and the Arnon. The climate is temperate, neither the heat nor the cold being excessive, but in the vicinity of the more sluggish streams there is a moisture in the air, deemed unfavourable to health. The department is very backward in its agriculture, and the farms are mostly small, being let on the Metayer system, and the rent being paid by a stipulated portion of the crops. The common rotation is a fallow and two crops of corn. The yearly produce, wheat and rye, is about equal, and of both, as well of barley and oats, there is a surplus. The vineyards, though extensive, are neglected, and the wine is badly managed, and of little repute. The manufactures are chiefly of the domestic kind, and supply the inhabitants with clothing and household and rural implements. The capital is Chateauroux, with 8500 inhabitants.

INDRE and LOIRE, a department of the north-west of France, formed out of the ancient district of Touraine. It extends over 2953 square miles, or, according to the *Royal Almanac*, 612,679 hectares. It is divided into three arrondissements, whose subdivisions are 24 cantons, and 311 communes, with 274,970 inhabitants. It is generally a level country, consisting of valleys, in which the rivers run, and of plains between, of moderate elevation, which, from their good cultivation and fertility, have been denominated the garden of France. There are, however, some parts of the department which are sandy heaths, and others where the chalk is so slightly covered with soil, as to render it unfit for profitable cultivation. It is well watered by the rivers Loire, Cher, Indre, Vienne, and the Creuse, and their respective tributary brooks, too numerous to be recounted. The climate is temperate like all the middle of France, with a pleasant spring and autumn, hot summer, and short but not severe winter. The forests cover one-ninth of the department, producing fuel and timber. The corn of this division is unequal to the consumption, one-fourth of which must be supplied from the neighbouring provinces. It yields, however, a surplus of each kind of domestic animals, and of their produce, and a most copious store of fruits of all kinds, some of which dried, as plums and apples, and others as almonds, filberts, walnuts, and chestnuts, with no preparation, form a considerable branch of commerce. It yields also good flax and hemp, and much honey and wax. The wine is chiefly white, and some of it, as well as of the red, is highly valued, but the greater part is made into brandy for distant markets. The rearing silk worms, which was once a considerable occupation, has been nearly abandoned. There are some mines of iron, whose ores are cleared and worked into the appropriate articles. The manufactures are inconsiderable, consisting of linen and woollen cloth, of some silk goods, paper, liquorice, and liqueurs. The capital of the department is the city of Tours.

INDUCTION, in *Logic* and *Rhetoric*, a consequence drawn from several propositions or principles first laid down; or a general inference deduced from a number of facts so arranged in the statement of them as to lead necessarily to the conclusion.

Induction, in *Law*, is putting a clerk or clergyman in possession of a benefice or living to which he is collated or presented.

Induction, in *Philosophy*. See Physics.

INDULGENCES, in the Roman Catholic church, are a remission of the punishment due to sins, granted by the church, and supposed to save the sinner from purgatory.

According to the doctrine which was once maintained by this church, all the good works of the saints, over and above those which were necessary towards their own justification, are deposited, together with the infinite merits of Jesus Christ, in one inexhaustible treasury, the keys of which were committed to St Peter, and to his successors the popes, who might open it at pleasure, and by transferring a portion of this superabundant merit to any particular person, for a sum of money, convey to him either the pardon of his own sins, or a release for any one in whom he felt interested, from the pains of purgatory. Such indulgences were first invented in the eleventh century, by Urban II., as a recompense for those who went in person upon the glorious enterprize of conquering the Holy Land. They were afterwards granted to those who hired a soldier for that purpose; and in process of time were bestowed on such as gave money for accomplishing any pious work enjoined by the pope.

The power of granting indulgences has been greatly abused in the church of Rome. Leo X., in order to carry on the magnificent structure of St Peter's at Rome, published indulgences, and a plenary remission, to all such as should contribute money towards it. Finding the project take, he granted to Albert, elector of Mentz and archbishop of Magdeburg, the benefit of the indulgences of Saxony and the neighbouring parts, and farmed out those of other countries to the highest bidders, who, in order to make the most of their bargain, procured the ablest preachers to cry up the value of the commodity. The form of these indulgences was as follows: "May our Lord Jesus Christ have mercy upon thee, and absolve thee by the merits of his most holy passion. And I, by his authority, that of his blessed apostles Peter and Paul, and of the most holy Pope, granted and committed to me in these parts, do absolve thee, first from all ecclesiastical censures, in whatever manner they have been incurred; then from all thy sins, transgressions, and excesses, how enormous soever these may be, even from such as are reserved for the cognizance of the holy see, and as far as the keys of the holy church extend: I remit to you all punishment which you deserve in purgatory on their account; and I restore you to the holy sacraments of the church, to the unity of the faithful, and to that innocence and purity which you possessed at baptism; so that when you die, the gates of punishment shall be shut, and the gates of the paradise of delight shall be opened: and if you shall not die at present, this grace shall remain in full force when you are at the point of death. In the name of the Father, and of the Son, and of the Holy Ghost."

The terms in which the retailers of indulgences described their benefits and the necessity of purchasing them, were so extravagant, that they appear almost incredible. If any man, said they, shall purchase letters of indulgence, his soul may rest secure with respect to its salvation. The souls confined in purgatory, for whose redemption indulgences were purchased, as soon as the money tinkled in the chest, instantly escaped from that place of torment, and ascended into heaven. They maintained that the efficacy of indulgences was so great, that the most heinous sins would be remitted and expiated by them, and the person freed from both guilt and punishment; that this was the unspeakable gift of God, in order to reconcile man to himself; and that the cross erected by the preachers of indulgences was equally efficacious with the cross of Christ itself.

It was this great abuse of indulgences which mainly contributed to the reformation of religion in Germany, where Martin Luther began to declaim first against the preachers of indulgences, and afterwards against indulgences themselves; but since that time the popes have become much more sparing in the exercise of this power.

INDULT, in the church of Rome, the power of presenting to benefices granted to certain persons by the pope. Of this kind is the indult of kings and sovereign princes in the Roman Catholic communion, and that of the parliament of Paris granted by several popes. By the concordat for the abolition of the pragmatic sanction, made between Francis I. and Leo X. in 1516, the French king had the power of nominating to bishoprics, and other consistorial benefices within his realm. At the same time, by a particular bull, the pope granted to him the privilege of nominating to the churches of Bretagne and Provence. In 1648 Pope Alexander VIII., and in 1668 Clement IX., granted the king an indult for the bishoprics of Metz, Toul, and Verdun, which had been yielded to him by the treaty of Munster; and in 1668 the same Pope Clement IX. granted him an indult for the benefices in the counties of Rousillon, Artois, and the Netherlands. The cardinals likewise have an indult granted them by agreement between Pope Paul IV. and the sacred college in 1555, which is always confirmed by the popes at the time of their election. By this treaty the cardinals have the free disposal of all the benefices depending on them, and are empowered likewise to bestow a benefice *in commendam*.

INDULTO, a duty, tax, or custom, paid to the king of Spain on all such commodities as are imported from the West Indies in the galleons.

INDUS, also called the Nilab and the Sinde. This great river has its rise in the mountains of Tartary, lying between the 38 and 39 degrees of N. Lat., and is formed by two great branches, which join at the town of Dras, about 100 miles N.E. from Cashmeer. The left of these branches is seventy yards broad a little above the junction, and excessively rapid; it comes from the north of east, and runs west after being joined by the branch which passes the city of Lechdack in Thibet. According to information given to Mr Elphinstone by a Cashmerian, these head branches of the Indus joined about twenty-four miles above Dras, and at or below that town, the river divided into two branches, the lesser one running south to Cashmeer, but the greater one he knew little about, excepting that it was called the great Sinde. After passing the city of Lechdack in Thibet, it takes a south-westerly course, and forcing its way through the mountains called the Hindoo Coosh, it enters Hindostan about Lat. 33° 15′ N. Here, about sixty miles from its source, it is joined by the Cabul or Attock from the west; and it increases both in breadth and in depth, being about three-quarters of a mile in breadth in the month of July, and no longer fordable. Forty miles above

Indus.

the fort of Attock east-north-east, it is confined between high mountains as far as Torbela, where it enters the valley of Chuch, spreading and forming innumerable islands till it reaches the fort of Attock, where it again enters between the hills. At the fort it is only 260 yards broad, and both deep and rapid. It enters a plain five miles south of Attock, and is again confined between hills at Nilah, ten miles south of Attock, and continues to wind amongst deep groups of mountains on to Harrabah, latitude 33° 7′, where it enters the rich valley of the Esa Khels in four great branches, and is not again interrupted in its course by hills. From this point to where it is joined by the fine rivers of the Punjab, and flows in one stream, its course is south-east; and it enters the province of Sinde between the 25th and 26th degrees of N. Lat. Mr Elphinstone crossed the Indus in lat. 31° 28′ in January 1809, when the stream was at the lowest, and found its breadth to be 1905 yards. The depth of the channel at its deepest part was not above twelve feet; and an elephant ten and a half feet in height, had not a hundred yards to swim; the main channel being here reduced by several large branches which separate from it, and run in a parallel course, one 200 yards, another 500 yards, and a third 50 yards broad. Major Rennell estimates the delta of the Indus to be about 150 miles in length along the sea-coast; and about 115 in depth, from the place of separation of the superior branches of the river, to the most prominent point of the sea-coast. There is here water for vessels of nearly 200 tons burden, from the Gulf of Cutch to Lahore, a distance of 760 geographical miles. About 170 miles from the sea, by the course of the river, the Indus divides into two branches, of which the westernmost is by much the larger; and, after a course of about fifty miles to the south-west, as it approaches the sea, it is again subdivided into several other branches and creeks. The lower part of the delta is intersected by rivers and creeks in almost every direction, like the delta of the Ganges; but it so far differs from the latter, that it has no trees on its surface, the dry parts being covered with brushwood, and the remainder, by much the largest part, being noisome swamps or muddy lakes. It is remarkable that the influence of the tides is not felt at a greater distance than sixty or sixty-five miles from the sea. At the mouths of the different branches, the rush or influx of the tide is high and dangerous, running, as has been estimated, at the rate of four miles an hour, though varying greatly at different places. From the sea up to Hyderabad, the Indus is in general about a mile in breadth, varying in depth from two to five fathoms. The river begins to swell in the middle of July, from the melting of the snows, and continues to increase until the end of August. The length of the Indus is estimated by Mr Elphinstone, on the best data that he could collect, to be from Lechdack to Rodack, a place where wool is brought, or sheep, through a hilly country, to Cashmeer, to be manufactured into shawls, 250 miles; thence to the fort of Attock, 400 miles; and 700 to the sea; in all 1350 miles.[1] The Indus admits of an uninterrupted navigation from Tatta, the capital of Sinde, to Moultan and Lahore, for vessels of 200 tons, and a very extensive trade was carried on between these places in the time of Aurungzebe; and it is mentioned by Mr Burnes, in his visit to the Court of Sinde in 1828, that above Bunosa, which is thirty miles below Hyderabad, the river is nearly a mile broad, studded with boats, filling its channel from bank to bank, and moving majestically forward, at the rate of about three miles an hour.[2] But the trade has been frequently interrupted by the disorderly state of the country, owing to the bad government of Sinde, and the predatory incursions of the Sikhs and petty chiefs, who possess the countries of Moultan and Lahore, or the banditti who live under their precarious authority. The upper part of the delta is well cultivated, yielding abundance of rice,[3] and Mr Burnes, in his journey across it from Cutch, describes the extensive cultivation and richness of the soil from Buree to Toorta, as every where remarkable. He had every where to cross a number of canals dug for the purposes of agriculture, from the branches of the Indus, and over many of which small brick bridges were thrown, on which draw-wells were constantly at work irrigating the fields; and he observed a strong contrast between the parched deserts of Cutch and the exuberance of vegetable life exhibited in the delta of the Indus. This great river is named the Sindhis or Sindhus in Sanscrit, and Aub Sinde, or the water of Sinde, by the Persians. It is called by the natives Attock, from that place downwards to Moultan, and farther down to Soor or Shoor, until it separates in the Delta. The Asiatics generally distinguish it by the name of Sinde. It forms a strong barrier on the west of Hindostan for nearly 900 miles, and, if the country were resolutely defended, it would be a formidable obstacle to an invading army. The bed of the Indus is sand, with a small quantity of mud, and the water is wholesome, and quite fresh. Mr Burnes estimates that the Indus pours into the sea about four times as much water as the Ganges.

Inebriants | Infalistacio.

INEBRIANTS, are defined to be such things as affect the nerves in a particular and agreeable manner, and through them alter and disturb the functions of the mind. They are properly divided into natural and artificial; the former being chiefly in use amongst the oriental and other nations, the latter principally amongst those of Europe.

Natural Inebriants, are, 1. Opium, which is in use all over the East; 2. *Peganum harmala*, or Syrian rue, the seeds of which are sold in Turkey for this purpose; 3. Maslac of the Turks, or bangue of the Persians, prepared from the dust of the male-flower of hemp, or from the leaves; 4. Bangue of the Indians, from the leaves of the *Hibiscus sabdarissa;* 5. Seeds of various species of the datura, or thorn-apple; 6. Pinang, or betel of the Indians; 7. Roots of black henbane; 8. The *Hyoscyamus physaloides;* 9. Berries of the deadly nightshade; 10. Leaves of milfoil, used by the Dalekarlians to render their beer intoxicating; 11. Tobacco, and several others less material, such as clary, saffron, and darnel.

Artificial Inebriants, are fermented liquors from farinaceous seeds; and wines and spirits drawn by distillation. With these are ranked the nectar of the gods, and the anodyne medicine of Homer, commonly called *nepenthe.*

INERTIA *of* MATTER is defined by Sir Isaac Newton to be a passive principle by which bodies persist in a state of motion or of rest, receive motion in proportion to the force impressing it, and resist as much as they are resisted. It is also defined by the same author to be a power implanted in all matter, whereby it resists any change endeavoured to be made in its state. See PHYSICS.

IN ESSE is applied to things which are actually existing. Authors make a difference between a thing *in esse*, and a thing *in posse.* A thing that is not, but may be, they say is *in posse*, or *potentia;* but a thing apparent and visible, they say is *in esse*, that is, it has a real being *eo instanti*, whereas the other is casual, and at best but a possibility.

INFALISTACIO, an ancient punishment of felons, by throwing them amongst the rocks and sands, and chiefly used in port-towns. It is the opinion of some writers, that *infalistatus* implied some capital punishment, by exposing the malefactor upon the sand till the next tide carried him

[1] Elphinstone's *Account of the Kingdom of Cabul.* Appendix, p. 653.
[2] Rennell, *Memoir of a Map of Hindostan*, p. 181.
[3] Burnes, *Narrative of a Visit to the Court of Sinde*, p. 40.

away; and of this custom, it is said, there exists an old tradition. However, the penalty seems to have taken its name from the Norman *falese*, or *falesia*, which signified not the sands, but the rocks and cliffs adjoining, or impending over the sea-shore. *Commisit feloniam ob quam fuit suspensus, ut legatus vel alio modo morti damnatus, ... vel apud Dover* infalistatus, *apud Southampton submersus.*

INFALLIBLE, that which cannot err, or be deceived. One of the great controversies between the Protestants and Catholics, is the infallibility which the latter attribute to the pope; though, in fact, they are not themselves agreed on that head, some placing this pretended infallibility in the pope and a general council, and others in his Holiness alone.

INFAMY, in *Law*, is that consequence of conviction for certain crimes, by which the person convicted incurs the *infamia juris*, and is thus rendered incapable of being a witness or juror, even though he be pardoned for his crime.

INFANCY, the first part of life. Hoffman says, that the human species are *infants* until they begin to talk, and *children* till the age of puberty. Anatomy discovers to us, that during infancy there is much imperfection in the human frame; its parts, for instance, are disproportioned, and its organs incapable of those functions which in future life they are designed to perform. The head is larger in proportion to the bulk of the body than that of an adult. The liver and pancreas are much larger in proportion than in advanced life; and their secretions are also more in quantity. The bile is very inert; the heart is stronger and larger than in future life; and the quantity of blood sent through the heart of an infant, in a given time, is also more in proportion than in adults. Though these circumstances have their usefulness, yet the imperfection attending them subjects this age to many injuries and dangers from which a more perfect state is exempt. Dr Percival observes, in his Essays, that of all the children who are born alive, two-thirds do not live to be two years old.

Infants have a larger proportion of brain than adults, and hence are most subject to nervous disorders; whilst the diagnostics of disease are in many respects obscure or uncertain, particularly those taken from the pulse, which, from the irritability of the tender bodies of infants, is suddenly affected by a variety of accidents too numerous, and seemingly too trivial, to gain our attention. From this cause, however, no very great embarrassment arises to the practitioner; for the disorders in this state are generally acute, less complicated than those in adults, and more easily discovered than is generally apprehended.

INFANTS, amongst the Jews, Greeks, and Romans, were swaddled as soon as they were born, in a manner similar to that practised by the moderns. The Jews circumcised and named their infant children on the eighth day from the birth. On the birth of a son, the Grecians crowned their doors with olives, on that of a daughter with wool. The infant was washed in warm water, and anointed with oil, and by the Spartans with wine; it was then dressed, and laid in a basket, or on a shield if the father was a warrior, particularly amongst the Spartans. At five days old they ran with it round the fire, and the mother's relations sent presents. The Greeks named their children on the tenth day, the Romans on the ninth; and this was attended with sacrifices and other demonstrations of joy.

INFANT, in *Law*, is a person under twenty-one years of age, whose capacities, incapacities, and privileges are various.

INFANTE, and INFANTA, all the sons and daughters of the kings of Spain and Portugal, except the eldest; the princes being called *infantes*, and the princesses *infantas*.

INFANTRY, in military affairs, the whole body of foot soldiers, whether consisting of independent companies or regiments. This word takes its origin from one of the infantas of Spain, who, finding that tne army commanded by the king her father had been defeated by the Moors, assembled a body of foot-soldiers, and with them engaged and totally routed the enemy. In memory of this event, and to distingush the foot-soldiers, who were not before held in much consideration, they received the name of *infantry*.

Heavy-armed INFANTRY, amongst the ancients, were such as wore a complete suit of armour, and engaged with broad shields and long spears. They formed the flower and strength of the Grecian armies. See ARMY.

Light-armed INFANTRY, amongst the ancients, were designed for skirmishing, and for fighting at a distance. Their weapons were arrows, darts, or slings.

Light INFANTRY, amongst the moderns, have only been in use since the year 1656. They have no camp equipage to carry, and their arms and accoutrements are lighter than those of the infantry. See ARMY.

INFATUATE, to prepossess any one in favour of some person or thing that does not deserve it, so that he cannot easily be disabused. The word comes from the Latin *fatuus*, fool; from *fari*, to speak out, which is borrowed from the Greek φαω, whence φατης, which signifies the same with *vates* in Latin, or *prophet* in English; and the reason is, because their prophets or priests used to be seized with a kind of madness, when they began to give out their predictions, or deliver oracles.

The Romans called those persons *infatuati*, who fancied that they had seen visions, or imagined that the god Faunus, whom they called *Fatuus*, had appeared to them. This word is more generally applied by the moderns to persons who are what the vulgar call *bewitched*, or under some peculiar destiny which it appears impossible for them to evade or escape.

INFEFTMENT, in *Scotch Law*, the symbolical surrender of an heritable subject to the purchaser, by delivering to him, in presence of witnesses, a small quantity of earth and stone of the property surrendered. It also denotes the writings which give effect to that ceremony.

INFERIÆ, sacrifices offered by the Romans to the *Dii Manes*, or the souls of deceased heroes or other illustrious persons, or even any relation or person whose memory was held in veneration. These sacrifices consisted of honey, water, wine, milk, the blood of victims, a variety of balsamic unguents, chaplets, and loose flowers. The victims upon these occasions were generally of the smaller cattle, though in ancient times they sacrificed slaves or captives. The sacrifices were usually black and barren. The altars upon which they were offered were holes dug in the ground.

The honey, water, wine, milk, and blood, were used as libations, and were poured upon the tombs of children by children, upon those of virgins by virgins, and upon those of married men by women. The *inferiæ* were offered on the ninth and thirtieth days after interment amongst the Greeks, and repeated in the month Anthesterion. The whole of this article applies equally to the Greeks and the Romans.

INFIBULATION, in antiquity. It was a custom amongst the Romans to infibulate their singing boys, in order to preserve their voices; for this operation, which is the very reverse of circumcision, kept them from injuring their voices by premature venery.

INFIDEL, a term applied to such persons as are not baptized, and do not believe in the truths of the Christian religion.

INFIDELITY, in a general sense, denotes want of faith or belief in regard to any subject or transaction. *Religious Infidelity* signifies a disbelief of Christianity.

"Of all the methods," says Dr Knox, "which the vanity of man has devised with a view to acquire distinction, there is none easier than that of professing a disbelief of the established religion. That which shocks the feelings of those with whom we converse, cannot fail of attracting notice; and as the vain are usually confident, they utter their doubts with an air so oracular and decisive, as induces the simple to think them profoundly wise. Audacity, with little ingenuity, will attract the eyes of spectators, and this will sufficiently answer the purpose of many amongst the professed unbelievers. One might be diverted, if one were not hurt, at seeing a circle of silly admirers, gaping and fixing their eyes on some half-learned and impudent prater, who throws out oblique insinuations against the Bible, the clergy, or the sacrament. These are fertile topics of wit and ingenuity; but it might mortify the vanity of some very vain writers and talkers, if they were to recollect, what is undoubtedly true, that it is a species of wit and ingenuity which not only the vilest, but the most stupid and illiterate of mankind, have frequently displayed in all its possible perfection.

" There is indeed no doubt, but that vanity is one of the principal causes of infidelity. It must be the sole cause of communicating it to others, by writing or conversation. For let us suppose the case of a very humane, judicious, and learned man, entertaining doubts of the truth of Christianity: If he cannot clear his doubts by examination, he will yet recollect that doubts are no certainties; and, before he endeavours to propagate his scepticism, he will ask himself these questions: ' Am I quite convinced that what I doubt of cannot possibly be true? If I am convinced of it, am I sure that the publication of my opinions will not do more harm than good? Is not the disturbing of any long-established civil constitution attended with confusion, rebellion, bloodshed, and ruin? And are not the majority of men more strongly attached to the religion than the government of their forefathers? Will it serve my country to introduce discontent of any species? May not those innovations in religion, which discontent may introduce, lead to all the evils which are caused by frenzy and fanaticism? Granting that I were able to make a party formidable enough to crush opposition and to exterminate Christianity, still am I certain that I act, in this instance, like a good member of society? For is not this system, whether well or ill founded, friendly to society? I must confess it; its greatest enemies have acknowledged it. What motive, then, can induce me to divulge my doubts of its authenticity? Not the good of mankind; for it is already allowed by unbelievers, that the good of mankind is interested in the belief of its divine original. Is it for my own good, and with a view to be convinced? I will not deceive myself: my motive, I suspect, is of another kind; for do I read those books which have been already written to satisfy similar doubts? Nothing but the vanity of appearing to be wiser than my credulous neighbours can induce me to interrupt the happiness of their belief. But vanity of this sort, which tends to disturb society, to injure the national morals, and to rob many thousand individuals of a copious source of sweet and solid comfort, must be pronounced extreme wickedness, even according to the obvious dictates of natural religion. I shall act the part of a good citizen and a good man, by conforming to a system whose beneficial influence I feel and confess, and by endeavouring to acquire a belief in that which has for so many centuries been established, and which promises to soothe me in distress with the sweetest consolations, and to brighten the dismal hour of death, by the hope of a more glorious and happy state of existence. At all events, I shall have the satisfaction of having commanded myself so far, as not to have run the hazard of endangering the welfare of my fellow-creatures, either here or hereafter, by indulging a degree of vanity, which, in a creature so weak and so short-lived as myself, is a folly very inconsistent with the superior wisdom which I seem to arrogate."

" I will venture to repeat," continues our author, " that all writers against Christianity, however they may affect even the extremes of benevolence, honour, philosophy, and enlargement of mind, are actuated by vanity and wickedness of heart. Their motives are as mean, selfish, narrow, and in every respect unjustifiable, as the tendency of their writings is mischievous. Their malice is often impotent, through the foolish sophistry of their arguments; but, if ever it be successful, it is highly injurious: and, indeed, considering their motives, and the probable consequences of their endeavours, the infidel writer is a greater enemy to society, and consequently guiltier, according to all the principles of social union, than the thief or the traitor. Persecution would, however, only promote his cause, and his proper punishment is contempt.

" It is certainly no derogation from the character of a man of sense, to conform, even while he is so unfortunate as to doubt their truth, to the opinions of his country. His conformity will probably lead him to a train of actions and of thought, which, in due time, will induce him to believe. But, if that should not happen, yet he will act, as very wise and very great men have acted, in paying a respectful deference to the avowed conviction of others. The most intelligent and powerful men of ancient Rome, not only appeared to believe a very absurd and hurtful system, but assisted in all its ceremonies as priests. Even Socrates, who evidently entertained some notions adequate to the dignity of the one great and supreme Being, yet thought it was a duty which he owed to his country, so far to conform to the wretched establishment, as to order in his dying words a sacrifice to Æsculapius. This external conformity to the national religion ought not to be confounded with hypocrisy. If, indeed, it is carried to extremes, or zealously affected, it certainly is very blameable and contemptible deceit; but while it keeps within the bounds of reason and moderation, it ought to be called a decent deference to the opinions of the majority, arising from humility, and from a desire to maintain the tranquillity of the state, and to continue an innocent and useful system, which has, and will always greatly contribute to lessen the quantity and degree both of moral and of natural evil.

" The easiest, after all, or at least the most effectual method of appearing in any character, is really to be what we wish to appear. But belief, you will say, is not in our power, and how can we believe what appears to us incredible? Certainly you cannot while it appears incredible. But let me ask you, whether you have taken any pains to believe, or have at once and at a glance persuaded yourself, that the Christian religion is totally false? It is probable that a great number of sceptical writers never gave themselves the trouble to read those Scriptures which they warmly oppose. They hear objections, they read objections, and they find, that from men of reputed wit and ingenuity the objections often originate. They also wish to be reputed men of wit and ingenuity, and therefore eagerly adopt the language and sentiments of the order. Perhaps the vanity and pride of this class of men will render all attempts to convince them abortive; but to modest doubters, and to those whose good sense and good dispositions lead them to wish to adopt the religion of their country, it may not be useless to suggest advice, with a view to facilitate their conviction.

" The chief thing required is to free themselves from the pride of human reason. Humility (and surely our blindness and imperfections are sufficient to render us humble, if we would be reasonable), humility will open our hearts, and belief will find admission. Sincere endeavours, seconded by prayers, will never fail to help our unbelief. But, alas! a fine, gay, spirited, liberal, and enlarged modern philosopher, would be ashamed to be found on his knees, or with a Testament in his possession. There is scarcely any vicious act, or any vicious book, which would put him so much to the blush.

"A modest well-meaning man might, however, one should think, divest himself of those prejudices which prevent the possibility of belief, by the following soliloquy:—I find myself placed in a world abounding with evil and misery. Under the immediate pressure of it, I feel my heart inclining, like the needle to the north, by its natural tendency, to the Deity for support. Man, of all animals, is the only one who has the sense of religion. Feeling this distinctive propensity of my nature, I look around to discover to what object, and in what manner, that part of my fellow creatures, who live in the same society with myself, pay their adoration. I find a system of religion already established, and which has been established in the most enlightened countries of the earth near two thousand years. I resolve to examine it. It claims that respect from its antiquity and universality. Many difficulties appear on the first inspection. My reason is often startled, and my belief wavers. But I will not yet give up a point of so serious importance, without further and closer attention to it. I reflect, that two thousand years is a vast space in the age of the world. How many myriads of men like myself have lived and died in the faith during that time. And were all of them fools or hypocrites? It could not have been. Can the understanding of a poor individual, just come into the world, and hardly knowing where he is, comprehend on intuition an object of such magnitude, and make the mighty discovery which has escaped millions of the wisest and most learned of mortals? Or, supposing that they all perceived the deception, am I then at last the only honest man who will confess it? I am ashamed to avow such an idea to myself. But yet, if I reject what they received, surely I avow it in the more expressive language of my conduct. Pride, I fear, is the foundation of my scepticism, and humility must form the basis of my belief. I will check my own presumption, and reject the cavils of vain and foolish philosophy. Shall a poor weak creature, who cometh up like a flower, and is cut down, who fleeth as a shadow, and never continueth in one stay, presume to pronounce decisively in that little period, in which he has scarcely time to look about him before he dies, against a system which has strong internal and external evidence of divine original, which is most useful and comfortable, and which has been admitted among a great portion of mankind during almost twenty centuries? No, it is the first wisdom to be humble. Humility will be followed by grace, and grace by faith, and faith by salvation. It plainly appears, that I can lose nothing by belief, but some of those excessive and irregular enjoyments which would destroy my health and life; but I may possibly gain a glory and a happiness which shall continue to all eternity."

INFINITE, that which has neither beginning nor end; in which sense God alone is infinite.

INFINITE is also used to signify that which has had a beginning, but will have no end, as angels and human souls. This makes what the schoolmen call *infinitum a parte post;* as, on the contrary, by *infinitum a parte ante,* they mean that which has an end, but had no beginning.

INFINITE Quantities. The very idea of magnitudes infinitely great, or such as exceed any assignable quantities, includes a negation of limits; yet if we examine this notion, we shall find that such magnitudes are not equal amongst themselves, but that there are really, besides infinite length and infinite area, three several sorts of infinite solidity, all of which are *quantitates sui generis,* and that those of each species are in given proportions.

Infinite length, or a line infinitely long, is to be considered either as beginning at a point, and so infinitely extended one way, or else both ways from the same point; in which case the one, which is a beginning infinity, is the one-half of the whole, which is the sum of the beginning and ceasing infinity; or, as may be said, of infinity *a parte ante* and *a parte post,* which is analogous to eternity in time and duration, in which there is always as much to follow as is past, from any point or moment of time; nor does the addition or subtraction of finite length, or space of time, alter the case either in infinity or eternity, since both the one or the other cannot be any part of the whole.

INFINITESIMALS, amongst mathematicians, are defined to be infinitely small quantities.

In the method of infinitesimals, the element, by which any quantity increases or decreases, is supposed to be infinitely small, and is generally expressed by two or more terms, some of which are infinitely less than the rest; and this being neglected as of no importance, the remaining terms form what is called the *difference of the proposed quantity.* The terms which are neglected in this manner, as infinitely less than the other terms of the element, are the very same which arise in consequence of the acceleration or retardation of the generating motion, during the infinitely small time in which the element is generated; so that the remaining terms express the elements which would have been produced in that time, if the generating motion had continued uniform; and therefore those differences are accurately in the same ratio to each other as the generating motions or fluxions. Hence, though in this method infinitesimal parts of the elements are neglected, the conclusions are accurately true without even an infinitely small error, and agree precisely with those which are deduced by the method by fluxions. See FLUXIONS.

INFINITIVE, in *Grammar,* the name of one of the moods, and so called in contradistinction to those that are finite. See GRAMMAR.

INFINITY, the quality which renders a thing infinite.

INFIRMARY, a kind of hospital, where the weak and sick are properly taken care of.

INFLAMMABILITY, that property of bodies which disposes them to kindle or catch fire. See CHEMISTRY.

INFLATION (formed from *in* and *flatus* from *flo,* I blow), blowing up, the act of stretching or filling any flaccid or distensible body with a flatulent or windy substance.

INFLECTION, called also *diffraction,* and *deflection,* in *Optics,* is a property of light, by reason of which, when it comes within a certain distance of any body, it is either bent from it, or towards it; which is a kind of imperfect reflection or refraction. See OPTICS.

INFLECTION, or *Point of INFLECTION,* in the higher geometry, is a point where a curve begins to bend in a contrary way.

INFLECTION, in *Grammar,* the variation of nouns and verbs, by declension and conjugation.

INFORMATION, in *Law,* is nearly the same in the crown office as that which in other courts is called a *declaration.* Informations are of two sorts; first, those which are partly at the suit of the king, and partly at that of a subject; and, secondly, such as are only in the name of the king.

INFORMER (*informator*) in *Law,* a person who informs against, or prosecutes in any of the king's courts, those that offend against any law or penal statute.

Informers were very common both in Greece and in Rome. Every corner of the streets was infested with persons who made it their constant business to pick up stories, and catch at every occasion to accuse persons of credit and reputation. These persons were called by the Greeks Συκοφανται; for a more particular account of whom see SYCOPHANT.

Amongst the Romans, informers were of two sorts, *mandatores* and *delatores.* These played into each other's hands; the former marking down such persons as they pretended to have found guilty of any misdemeanour, and the latter prosecuting them. What tended to increase the number of these pestilent wretches was, that the informers were entitled to a fourth part of the effects of the person convicted. Wicked princes rewarded and countenanced this mischievous tribe; but Titus set on foot a most diligent search after them, and punished such as he found with death or banishment. Trajan also is praised by Pliny for pursuing similar conduct.

INFRACTION (formed from *in*, and *frango*, "I break"), a rupture or violation of a treaty, law, ordinance, or the like.

INFRALAPSARII, the name of a sect of predestinarians, who maintain, that God has created a certain number of men only to be damned, without allowing them the means necessary to save themselves, if they would; and they are thus called, because they hold that God's decrees were formed *infra lapsum*, after his knowledge of the fall, and in consequence thereof. The Infralapsarians are contradistinguished from the SUPRALAPSARIANS.

INFULA, in antiquity, was a mitre worn upon the head by the Grecian and Roman priests, and from which on each side hung a riband. The covering of the head with a mitre was rather a Roman than a Grecian custom, introduced into Italy by Æneas, who covered his head and face at the performance of sacrifice, lest any ill-boding omen should disturb the rites. The *infulæ* were commonly made of wool, and were not only worn by the priests, but were put upon the horns of the victims, upon the altar and the temple. The *infulæ* were also called *vittæ*.

INFUSION, in *Pharmacy*, an operation, by which the virtues of plants are drawn out, by steeping them in some convenient fluid without boiling.

INGATESTONE, a town of the county of Essex, on the hundred of Chelmsford, twenty-three miles from London. In the church are several fine monuments of the noble family of Petre, whose residence is here. There is an endowed classical school. The inhabitants amounted in 1801 to 645, in 1811 to 640, in 1821 to 747, and in 1831 to 789.

INGELMUNSTER, a large town of the Netherlands, in the province of Courtray. It stands on the river Mandelbeke, on the great road from Bruges to Courtray, and contains 5350 inhabitants, chiefly occupied in making linen goods and fine thread-lace.

INGENHOUSZ, JOHN, an eminent physician and natural philosopher, was born at Breda in 1730. He was first established in medical practice there, but removed to London in 1767, particularly with a view to study the improved methods of inoculation then recently introduced. Having become acquainted with Sir John Pringle, at that time President of the Royal Society, he was by him recommended to the Austrian ambassador, for the purpose of inoculating the Imperial family at Vienna, the Empress Maria Theresa having lost two of her children by the natural small-pox. He accepted this engagement in 1768, and having been perfectly successful in his operations, he was remunerated by the grant of a pension of L.600 a-year for life, together with the titles of Aulic Counsellor and Physician to the Imperial Family. He was also consulted, in his medical capacity, by many others of the most distinguished personages at Vienna, and he enjoyed the particular esteem of the Emperor Joseph II., who was fond of receiving him in his cabinet, and of witnessing the exhibition of a variety of physical experiments, with which it was always the delight of Ingenhousz to amuse and instruct his acquaintance of both sexes. The following spring he went to Italy, and inoculated the Grand Duke of Tuscany. He was made a Fellow of the Royal Society in May 1769; but he appears to have remained some years in Italy, for he was at Leghorn in January 1773; in March he dates from Salzburg; and in November 1775 from Vienna. The next year he was in London; and, in the winter of 1779, he went to Paris. The latter part of his life he spent principally in England, which, notwithstanding his dislike to the chillness of the climate, was always his favourite residence, and "where he enjoyed during many years," to use his own words, "that felicity which a free and independent man finds in the pursuit of knowledge and wisdom, in the society and friendly intercourse of those who have distinguished themselves by their learning."

Dr Ingenhousz was cheerful in his disposition, and often playful in his conversation. Though his pursuits were chiefly scientific, he was not destitute of taste for literature and poetry. He had a particular predilection for Lucan, and for the Cardinal de Polignac, and would frequently recite passages from their poems with great energy, and with a strong German accent. Nor did he disdain the comforts of commercial opulence, and he was often a visitor at the magnificent villa of the late Mr Rucker of Rohampton. He had been introduced there by his friend Dr Brocklesby, who was in many respects of a perfectly congenial disposition, and who had great pleasure in prevailing on him to partake occasionally of his own hospitality, when his table would otherwise have been solitary. He died the 7th September 1799, at Bow Wood, in Wiltshire, the house of the Marquis of Lansdown, who had long known and esteemed him.

Dr Ingenhousz's principal publications are, 1. *Experiments on the Torpedo. Phil. Trans.* 1775, p. 1. Mr Walsh had lately gained considerable reputation by his account of the effects of the torpedo. These experiments, which were made off Leghorn, in company with Dr Drummond, are merely illustrative of the properties of that animal, which are now better known; and they afford no decided test of the electrical nature of the phenomena.

2. *Methods of Measuring the Bulk of Mixtures of Common Air, and Nitrous Air, with Experiments on Platina. Phil. Trans.* 1776, p. 257. The eudiometrical apparatus is described as an improvement on Fontana's. The experiments are intended to shew that platina is not an alloy of iron and gold, since it may be deprived of all magnetic properties by repeated cupellation.

3. *A Way of Lighting a Candle by an Electrical Spark. Phil. Trans.* 1778, p. 1022. A very small charged jar setting fire to pulverised resin, strewed on cotton.

4. *On the Electrophorus*, p. 1027. This is a Bakerian lecture, read by appointment of the President and Council of the Royal Society, relating to the instrument then lately invented by Professor Volta, and which had been made known to the author by the Archduke Ferdinand. Its action is explained upon the elementary principles of the Franklinian theory. The next article in the volume contains some experiments of Mr Henly in confirmation of the doctrines here advanced.

5. *On a New Inflammable Gas. Phil. Trans.* 1779, p. 576. A powerful explosion is produced by the detonation of the vapour of a single drop of ether with oxygen gas. The author takes occasion to investigate the elasticity of the gas evolved by the detonation of gunpowder; and agrees with Bernoulli in estimating it as equivalent to near 2500 atmospheres. It may here be remarked, that notwithstanding Bernoulli's general accuracy, and great mathematical talents, he has fallen into a very singular error, in comparing the force of gunpowder with the daily labour of men; and has accidentally made the force of one pound equivalent to the daily work of 100 men, while, in fact, the force of 40 pounds is only equivalent to the daily labour of a single man.

6. *On a Mode of Suspending Magnetical Needles*, p. 537. Proposing that a hollow needle should be immersed in linseed oil, so as to press with a small portion of its weight only on its axis, in order that the friction may be greatly diminished.

7. *Improvements in Electricity*, p. 661. On plate ma-

chines of glass and pasteboard, and on a riband machine. A Bakerian lecture.

8. *Experiments on Vegetables.* London, 1779. This volume is chiefly occupied by the detailed proofs of the author's principal discovery, that vegetables in general pour out a portion of oxygen gas in the sunshine, while they rather diminish its proportion at night and in the shade. It is dedicated to Sir John Pringle, and was translated into *French* by the author. Paris, 1786. Second edition, 2 vols. 8vo, 1787–9. *Latin by Scherer.* Vienna, 1786. *Dutch by Dr Van Breda,* of Delft, with others of his works.

9. *On the Salubrity of the Air at Sea, and at Places far removed from the Sea. Phil. Trans.* 1780, p. 554. From the imperfection of the test employed, it was easy to imagine that some differences were discovered, which subsequent observations have shewn to have no existence.

10. *Nouvelles Expériences et Observations,* 2 vols. 8vo. Paris. On different subjects of natural philosophy. In German by *Molitor, Vermischte Schriften.* Vienna, 1784.

11. *On the Influence of the Vegetable Kingdom in the Animal Creation. Phil. Trans.* 1782, p. 426. Asserting the accuracy of his experiments, and denying some statements of Dr Priestley; advancing, in particular, many arguments to prove that the air obtained is really supplied by the vegetables, and not by the water in which they are usually immersed, in order to collect it. Dr Ingenhousz was, on all occasions, anxious to support his claim to this very interesting discovery; and he insisted that Priestley's earlier experiments, on the green matter contained in stagnant water, had little or nothing in common with his own, because that matter was, in fact, of an animal nature. He was in the habit of collecting the gas from cabbage leaves, and of keeping it bottled up in his pocket; and he was prepared with some coils of iron wire fastened into the corks, in order to exhibit the brilliant phenomenon of their combustion to his friends; the public being at that time less accustomed to this dazzling exhibition, than it has become in later years, when elementary lectures on chemistry have been more commonly addressed to mixed audiences than heretofore.

12. *Essay on the Food of Plants,* 8vo. London, 1798. From the French.

13. Dr Ingenhousz also inserted some essays in different volumes of the *Journal de Physique;* but they possess less originality and importance than his English publications.

(Chalmers's *Biographical Dictionary,* xix. London, 1815, 8vo; Kesteloot in *Biographie Universelle,* xxi. Paris, 1818, 8vo.) (L. L.)

INGENUOUS, in a general sense, signifies *open, fair,* and *candid.*

Ingenuous (*ingenuus*), in Roman antiquity, an appellation given to persons born of free parents, who had never been slaves. The children of the *liberti,* or persons who had obtained their liberty, were called *libertini,* not *ingenui;* this appellation of *ingenuus* being reserved for their children, or the third generation.

INGERAM, a town of the south of India, in the northern circars, district of Rajamundry, five miles south from Corenga. Longitude 82° 25′ east, latitude 16° 46′ north.

INGESTA, is used by some authors to express all sorts of aliment taken into the body.

INGLIS Island, a long island on the north coast of New Holland, near the entrance into the Gulf of Carpentaria. It is on the west side of the gulf, and is twelve miles long, and from one to three miles in breadth.

INGLUVIES, the crop or craw of granivorous birds, serving for the immediate reception of the food, where it is macerated for some time before it is transmitted to the true stomach.

INGOLSTADT, a city of the kingdom of Bavaria in the circle of Regen, on the right bank of the Danube is one of those places which has declined by the loss of its woollen manufactures, which were formerly of great extent. It is now merely the seat of the courts of justice and revenue for the circle. It contains a royal palace, nine churches, an hospital and public school, and 745 houses, inhabited by 4820 persons. Latitude 48° 45′ 55″, longitude 11° 20′ 32″ east.

INGOT, a mass of gold or silver melted down, and cast in a mould, but not coined or wrought.

INGRAFTING. See Horticulture.

INGRATITUDE, the opposite of gratitude. Ingratitude is a crime so shameful, that there never was a man found who would own himself guilty of it; and, though too frequently practised, it is so abhorred by the general voice, that to be ungrateful is to be liable to the imputation of the guilt or the capability of committing all other crimes.

In a little work entitled *Friendly Cautions to Officers,* the following atrocious instance of ingratitude is related. An opulent city in the west of England, little used to have troops with them, had a regiment sent to be quartered there; and the principal inhabitants and wealthiest merchants, glad to shew their hospitality and attachment to their sovereign, took the first opportunity to get acquainted with the officers, inviting them to their houses, and shewing them every civility in their power. This was truly a desirable situation. A merchant, extremely easy in his circumstances, took so prodigious a liking to one officer in particular, that he gave him an apartment in his own house, and made him in a manner absolute master of it, the officer's friends being always welcome to his table. The merchant was a widower, and had only two favourite daughters; the officer, in so comfortable a station, cast his wanton eyes upon them; and too fatally succeeding, ruined both. The consequence of this ungenerous action was, that all officers were ever afterwards shunned as a public nuisance, and a pest to society; nor have the inhabitants perhaps yet conquered their aversion to a red-coat.

We are informed by Rapin, that during Monmouth's rebellion, in the reign of James II. a certain person knowing the humane disposition of one Mrs Gaunt, whose life had been one continued exercise of beneficence, fled to her house, where he was concealed and maintained for some time. Hearing, however, of the proclamation, which promised an indemnity and reward to those who discovered such as harboured the rebels, he betrayed his benefactress; and such was the spirit of justice and equity which prevailed amongst the ministers, that he was pardoned and recompensed for his treachery, whilst she was burned alive for her charity.

The following instance is also mentioned by the same author. Humphry Bannister and his father were both servants to and raised by the Duke of Buckingham, who being driven to abscond, by an unfortunate accident befalling the army he had raised against the usurper Richard III., retired, without footman or page, to Bannister's house near Shrewsbury, as to a place where he had all the reason in the world to expect security. Bannister, however, upon the king's proclamation, promising L. 1000 reward to him who should apprehend the duke, betrayed his master to John Merton, high sheriff of Shropshire, who sent him under a strong guard to Salisbury, where the king then was, and there in the market-place the duke was beheaded. But divine vengeance pursued the traitor Bannister; for demanding the L. 1000 which was the price of his master's blood, King Richard refused to pay it, saying, that "he who would be false to so good a master, ought not to be encouraged." He was afterwards hanged for manslaughter, his eldest son run mad and died in a hog-sty, his second became deformed and lame, and his third son was drowned in a small puddle of water. His eldest daughter was seduced by one of his own carters, and his second was seized with a leprosy of which she died.

The following barbarous instances are from ancient History. When Xerxes king of Persia was at Celene, a city of Phrygia, Pythius, a Lydian, who had his residence in that city, and next to Xerxes was the most opulent prince of those times, entertained him and his whole army with an incredible magnificence, and made him an offer of all his wealth towards defraying the expenses of his expedition. Xerxes, surprised and charmed at so generous an offer, had the curiosity to inquire to what sum his riches amounted. Pythius made answer, that having the design of offering them to his service, he had taken an exact account of them, and that the silver he had by him amounted to two thousand talents (about L. 255,000 Sterling), and the gold to four millions of darics (about L. 1,700,000 Sterling). All this money he offered him, telling him that his revenue was sufficient for the support of his household. Xerxes made him very hearty acknowledgments, and formed a particular friendship for him, but declined accepting his present. The same prince who had made such obliging offers to Xerxes, having desired a favour of him some time afterwards, that out of his five sons who served in his army, he would be pleased to leave him the eldest, in order to be a comfort to him in his old age, the king was so enraged at the proposal, though so reasonable in itself, that he caused the eldest son to be killed before the eyes of his father, giving the latter to understand, that it was a favour he spared him and the rest of his children. Yet this is the same Xerxes who is so much admired for his humane reflection at the head of his numerous army, " that of so many thousand men, in a hundred years time there would not be one remaining; on which account he could not forbear weeping at the uncertainty and instability of human things." He might have found another subject of reflection, which would have more justly merited his tears and affliction, had he turned his thoughts upon himself, and considered the reproaches he deserved for being the instrument of hastening the fatal term to millions of people, whom his cruel ambition was going to sacrifice in an unjust and unnecessary war.

Basilius Macedo the Emperor, exercising himself in hunting, a sport he took great delight in, a great stag running furiously against him, fastened one of the branches of his horns in the emperor's girdle, and pulling him from his horse, dragged him a good distance, to the imminent danger of his life; which a gentleman of his retinue perceiving, drew his sword and cut the emperor's girdle asunder, which disengaged him from the beast, with little or no hurt to his person. But observe what reward he had for his pains. " He was sentenced to lose his head for putting his sword so near the body of the emperor;" and suffered death accordingly.

INGRESS, in *Astronomy*, signifies the sun's entering the first scruple of one of the four cardinal signs, especially Aries.

INGROSSER, or ENGROSSER, in common law, is one who buys up corn growing, or any provisions by wholesale, before the market, to sell again. It also signifies a clerk who writes records or instruments of law on skins of parchment.

INGULPHUS, abbot of Croyland, and author of the history of that abbey, was born in London about the year 1030. He received the first part of his education at Westminster; and when he visited his father, who belonged to the court of Edward the Confessor, he was so fortunate as to engage the attention of Queen Elgitha. That amiable and learned princess took a pleasure in examining our young scholar on his progress in grammar, and in disputing with him in logic; nor did she ever dismiss him without some present as a mark of her approbation. From Westminster he went to Oxford, where he applied to the study of rhetoric, and the Aristotelian philosophy, in which he made greater proficiency than many of his contemporaries. When he was about twenty-one years of age, he was introduced to William Duke of Normandy, who visited the court of England in the year 1051, and made himself so agreeable to that prince, that he appointed him his secretary, and carried him with him into his own dominions. In a little time he became the prime favourite of his prince, and the dispenser of all preferments, humbling some, and exalting others, at his pleasure; a station in which he confessed he did not behave with a proper degree of modesty and prudence. This excited the envy and hatred of many of the courtiers; to avoid the effects of which, he obtained leave from the duke to undertake a pilgrimage to the Holy Land. With a company of thirty horsemen he joined Sigfrid Duke of Mentz, who, with many German nobles, bishops, clergy, and others, was preparing for a pilgrimage to Jerusalem. When they were all united, they formed a company of no fewer than seven thousand pilgrims. In their way they spent some time at Constantinople, performing their devotions in the several churches. In their passage through Lycia, they were attacked by a tribe of Arabs, who killed and wounded many of them, and plundered them of a prodigious amount of money. Those who escaped from this disaster at length reached Jerusalem, visited all the holy places, and bedewed the ruins of many churches with their tears, giving money for their reparation. They intended to have bathed in Jordan; but being prevented by the roving Arabs, they embarked on board a Genoese fleet at Joppa, and landed at Brundusium, whence they travelled through Apulia to Rome. Having gone through a long course of devotions in this city, at the several places distinguished for sanctity, they separated, and every one made the best of his way to his own country. When Ingulph and his company reached Normandy, they were reduced to twenty half-starved wretches, without money, clothes, or horses; the ordinary result of the disastrous journeys into the Holy Land, so common in those times. Ingulph was now so much disgusted with the world, that he resolved to forsake it, and became a monk in the abbey of Fontenelle in Normandy; in which, after some years, he was advanced to the office of prior. When his old master was preparing for his expedition into England in 1066, he was sent by his abbot a hundred merks in money, and twelve young men, nobly mounted and completely armed, as a present from the abbey. Ingulph having found a favourable opportunity, presented his men and money to his prince, who received him very graciously. In consequence of this, the Conqueror raised him, in 1076, to the government of the rich abbey of Croyland in Lincolnshire, where he spent the last thirty-four years of his life, governing that society with great prudence, and protecting their possessions from the rapacity of the neighbouring barons by the favour of his royal master. The lovers of English history and antiquities are much indebted to this learned abbot, for his excellent history of the abbey of Croyland, from its foundation in 664 till 1091, into which he has introduced much of the general history of the kingdom, with a variety of curious anecdotes which are nowhere else to be found. Ingulph died of the gout, at his abbey, in 1109, in the seventy-ninth year of his age. His history is printed in Gale's Collection of early English Historians. A separate edition was published at Oxford in the year 1684.

INHERITANCE, a perpetual right or interest in lands, invested in a person and his heirs.

INHIBITION, a writ to inhibit or forbid a judge from further proceeding in a cause depending before him.

In *Scotch Law*, it is a writ obtained at the suit of a creditor against his debtor, prohibiting him from selling or contracting debts upon his estate to the creditor's prejudice.

INJECTION, the forcibly throwing certain liquid medicines into the body by means of a syringe, tube, clyster-pipe, or the like.

INJECTION, in *Surgery*, the throwing in some liquor or medicine into a vein opened by incision. See SURGERY.

INISTIOGE, a post town of Kilkenny, in the province of Leinster. It is situated upon the Nore, at sixty-three miles distance from Dublin.

INITIATED, a term properly used in speaking of the religion of the ancient heathens, where it signifies being admitted to the participation of the sacred mysteries. The word comes from the Latin *initiatus*, from *initiare*, *initiari*, which properly signifies to begin sacrificing, or to receive or admit a person to the beginning of the mysteries, or of ceremonies of less importance.

The ancients never discovered the deeper mysteries of their religion, nor even permitted some of their temples to be opened, to any but those who had been initiated. See MYSTERY.

INJUNCTION, in *Law*, a writ generally grounded upon an interlocutory order or decree out of the Court of Chancery or Exchequer, sometimes to give possession to the plaintiff, for want of the defendant's appearance; sometimes to the King's Ordinary Court, and sometimes to the Court-Christian, to stop proceedings in a cause, upon suggestion made, that the rigour of the law, if it take place, will be against equity and conscience in that case, that the complainant is not able to make his defence in these courts, for want of witnesses, &c., or that they act erroneously, denying him some just advantage. The writ of injunction is directed not only to the party himself, but to all and singular his counsellors, attorneys, and solicitors; and if any attorney, after having been served with an injunction, proceeds afterwards contrary to it, the Court of Chancery will commit the attorney to the Fleet for contempt. But if an injunction be granted by the Court of Chancery in a criminal matter, the Court of King's Bench may break it, and protect any who proceed in contempt of it.

INK, a black liquor, used in writing. The name is also applied to liquids and pigments of various colours, used in printing as well as in writing. We shall notice these compounds in the following order, 1. Black Writing Ink, comprehending under this head the ordinary methods of composition recommended by chemists, the improvements which a more extended manufacture have effected, the methods suggested for rendering ink imperishable, and the inquiries which have been instituted into the composition of ancient inks, with the methods proposed for renewing faded writing; 2. Indian Pigment or Ink; 3. Red Ink; 4. Blue Ink; 5. Printing Ink; 6. Ink for the Rolling Press; 7. Lithographic Ink; 8. Sympathetic Ink.

Black Writing INK. The properties which this liquor ought to have, are, 1. To flow freely from the pen, and sink a little into the paper, that the writing may not be easily discharged; 2. a very deep black colour, which should be as deep at first as at any time afterwards; 3. durability, so that the writing may not be subject to decay by age; and 4. ink should be destitute of any corrosive quality, that it may not destroy the paper, or go through it in such a manner as to render the writing illegible.

In Mr Delaval's *Treatise on Colours*, (p. 37), he acquaints us, that with an infusion of galls and iron filings, he had not only made an exceedingly black and durable ink, but by its means, without addition of any acid, dyed silk and woollen cloth of a good and lasting black. This kind of ink, however, though the colour is far superior to that of any other, has the inconvenience of being very easily discharged, either by the smallest quantity of any acid, or even by simple water; because it does not penetrate the paper in such a manner as is necessary to preserve it from the instantaneous action of the acid or of the water. During the action of the infusion of galls upon the iron in making this kind of ink, a very considerable effervescence takes place, and a quantity of air is discharged, the nature of which has not yet been examined.

The materials usually employed for the making of ink are, common green vitriol, or copperas, and galls; but almost all of them are deficient in durability, which is a property of such importance, that Dr Lewis thought the subject of ink-making not unworthy of his attention. From experiments made by that author, he infers, that the decay of inks is chiefly owing to a deficiency of galls; that the galls are the most perishable ingredient, the quantity of these, which gives the greatest blackness at first (that is, about equal parts with the vitriol), being insufficient to maintain the colour; that, for a durable ink, the quantity of galls cannot be much less than three times that of the vitriol; that it cannot be much greater without lessening the blackness of the ink; that by diminishing the quantity of water, the ink is rendered blacker and more durable; that distilled water, rain-water, and hard spring-water, have the same effects; that white wine produces a deeper black colour than water; that the colour produced by vinegar is deeper than that by wine; that proof-spirit extracts only a reddish brown tinge; that the last-mentioned tincture sinks into, and spreads upon, the paper; and hence the impropriety of adding spirit of wine to ink, as is frequently directed, to prevent mouldiness or freezing; that other astringents, as oak-bark, bistort, sloe-bark, &c. are not so effectual as galls, nor give so good a black, the colour produced by most of these, excepting oak-bark, being greenish; that the juice of sloes does not produce a black colour with martial vitriol; but that, nevertheless, the writing made with it becomes black, and is found to be more durable than common ink: that inks made with saturated solutions of iron, in nitrous, marine, or acetous acids, in tartar, or in lemon juice, were much inferior to the ink made with martial vitriol; that the colour of ink is depraved by adding quicklime, which is done with an intention of destroying any superabundant acid which may be supposed to be the cause of the loss of the colour of ink; that the best method of preventing the effects of this superabundant acid is probably by adding pieces of iron to engage it; that this conjecture is confirmed by an instance the author had heard, of the great durability of the colour of an ink in which pieces of iron had been long immersed; and lastly, that a decoction of logwood used instead of water, sensibly improves both the beauty and deepness of the black, without disposing it to fade. The same author observes, that the addition of gum-arabic is not only useful, by keeping the colouring matter suspended in the fluid, but also by preventing the ink from spreading, by which means a greater quantity of it is collected on each stroke of the pen. Sugar, which is sometimes added to ink, is found to be much less effectual than gums, and to have the inconvenience of preventing the drying of the ink. The colour of ink is found to be greatly injured by keeping the ink in vessels made of copper or of lead, and probably of any other metal, which the vitriolic acid can dissolve.

The foregoing experiments point out the best proportions of the ingredients for ink, one part of green vitriol, one part of powdered logwood, and three parts of powdered galls. The best menstruum appears to be vinegar or white wine, though for common use water is sufficient. If the ink be required to be of a full colour, a quart, or at most three pints, of liquor, may be allowed to three ounces of galls, and to one ounce of each of the other two ingredients. Half an ounce of gum may be added to each pint of the liquor. The ingredients may be all put together at once in a convenient vessel, and well shaken four or five times each day. In ten or twelve days the ink will be fit for use, though it will improve by remaining longer on the in-

Ink.

gredients. Or it may be made more expeditiously, by adding the gum and vitriol to a decoction of galls and logwood in the menstruum. To the ink, after it has been separated from the feculencies, some coarse powder of galls, from which the fine dust has been sifted, together with one or two pieces of iron, may be added, by which its durability will be secured.

Such is the substance of the discoveries and inquiries made by Dr Lewis and other chemists, relative to the composition of black writing ink, and upon modifications of them, most of the methods hitherto followed in making it have been founded. It might be supposed that after the determination, by such authority, of the relative proportions of the usual ingredients, it would only have been necessary to attend to that proportion, and that the result would be uniformly satisfactory. Experience, however, has shewn the reverse of this; and it is often found that the same ingredients, and the same proportions of them, produce inks of very different qualities. This arises from two causes, which were not apparent to the experimenting chemist. His attention was chiefly directed to the *immediate* effect produced by the mixture he prepared, or the additions made to it. Hence his experiments generally led him to the formation of a good black *dye*, if applied to immediate use; whilst the *ultimate* effect of the action of the atmosphere on the liquid itself, and the decomposition which frequently resulted, from the quantity of vegetable matter contained in it, were seldom brought under his notice. To these two causes, as well as the various modes of extract and of mixture, are to be attributed the very different results which have arisen from the use of the same ingredients and the same proportions of them; and on the connexion and regulation of these two agents, we believe the quality of the ink to depend, as much as upon the nature and proportion of the materials employed. This opinion is strengthened by the information we have received from Mr Morison (the extent of whose ink manufactories is a remarkable instance of the importance of the most minute branch of the arts, at the present day, in Great Britain), who has assured us, that he never could depend on the quality of the ink which was to be produced from any mixture of ingredients, however well manipulated, or however strong, until he adopted a method of abstracting that part of the vegetable ingredients which induced decomposition; a process which required much time and attention, but in the accomplishment of which so full opportunity was given for the action of the atmosphere that the liquid was not liable to be afterwards affected by either cause.

In some attempts made by Dr Lewis to endow writing ink with the great durability of that of the ancients, as well as the properties which it has at present, he first thought of using animal glues, and then of oily matters. "I mixed both lamp-black," says he, "and ivory-black with solutions of gum-arabic, made of such consistence as just to flow sufficiently from the pen. The liquors wrote of a fine black colour; but when dry, part of the colour could be rubbed off, especially in moist weather, and a pencil dipped in water washed it away entirely.

"I tried solutions of the animal-glues with the same event. Isinglass or fish-glue being the most difficultly dissoluble of these kinds of bodies, I made a decoction of it in water, of such strength that the liquor concreted into a jelly before it was quite cold. With this jelly, kept fluid by sufficient heat, I mixed some ivory-black. Characters drawn with this mixture on paper bore rubbing much better than the others, but were discharged without much difficulty by a wet pencil.

"It was now suspected, that the colour could not be sufficiently fixed on paper without an oily cement. As oils themselves are made miscible with watery fluids by the intervention of gum, I fixed some of the softer painters' varnish, after mentioned, with about half its weight of a thick mucilage of gum arabic, working them well together in a mortar till they united into a smooth uniform mass. This was beaten with lamp-black, and some water added by little and little, the rubbing being continued till the mixture was diluted to a due consistence for writing. It wrote freely, and of a full brownish black colour; the characters could not be discharged by rubbing, but water washed them out, though not near so readily as any of the foregoing. Instead of the painters' varnish or boiled oil, I mixed raw linseed oil in the same manner with mucilage and lamp-black; and on diluting the mixture with water, obtained an ink not greatly different from the other.

"Though these oily mixtures answered better than those with simple gums or glues, it was apprehended that their being dischargeable by water would render them unfit for the purposes intended. The only way of obviating this imperfection appeared to be, by using a paper which should admit the black liquid to sink a little into its substance. Accordingly, I took some of the more sinking kinds of paper, and common paper made damp as for printing, and had the satisfaction to find, that neither the oily nor the simple gummy mixtures spread upon them so much as might have been expected, and that the characters were as fixed as could be desired, for they could not be washed out without rubbing off part of the substance of the paper itself.

"But a further improvement may yet be made, namely, that of uniting the ancient and modern inks together; or using the common vitriolic ink instead of water, for tempering the ancient mixture of gum and lamp-black. By this method it should seem that the writings would have all the durability of those of former times, with all the advantage that results from the vitriolic ink fixing itself in the paper. Even where the common vitriolic mixture is depended on for the ink, it may in many cases be improved by a small addition of the ancient composition, or of the common Indian ink, which answers the same purpose. When the vitriolic ink is dilute, and flows so pale from the pen, that the fine strokes, on first writing, are scarcely visible, the addition of a little Indian ink is the readiest means of giving it the due blackness. By this admixture it may be presumed also that the vitriolic ink will be made more durable, the Indian ink in some measure covering it, and defending it from the action of the air. In all cases, where Indian ink or other similar compositions are employed, cotton should be used in the ink-stand, to prevent the settling of the black powder."

There is little doubt that the monkish ink was a composition of this nature, combining in some degree the ancient and modern materials. The ancient ink must have been very similar to the Indian or Chinese cakes. Pliny and Vitruvius both mention it as a preparation of soot, or lamp-black, with glue or gum; and Dioscorides gives the proportions of three parts of soot to one of gum. To this the liquor extracted from the cuttle-fish had sometimes been added. When this could not be had, there is indeed great reason to believe that some of the modern vitriolic ingredients were added by the ancients; many of the manuscripts of the Greek and Roman authors, erased by the monks, having been found to retain as much of the vitriolic principle as to become again legible on the application of chemical tests.

In the Philosophical Transactions for 1787, Dr Blagden gives some account of a method of restoring decayed inks so as to render them legible. His experiments originated from a conversation with Mr Astle, on the question whether the inks made eight or ten centuries ago, and which are found to have preserved their colour very well, were made of the same materials now employed or not? In order to decide the question, Mr Astle furnished the doctor with several manuscripts on parchment and vellum from the ninth to the fifteenth centuries inclusively. Some of these were still very black; others of different shades, from a deep yellowish brown to a very pale yellow, in some parts so faint that it could scarcely be seen. This was tried with simple and phlogisticated alkalies, the mineral acids, and infusion of galls. From these experiments it appeared that the ink anciently employed was of the same nature as at present. The letters turned of a reddish or yellowish brown, with alkalies became pale, and were at length obliterated by the diluted mineral acids. The drop of acid liquor, which had been put upon a letter, changed to a deep blue or green on the addition of phlogisticated alkalies; with an infusion of galls, in some cases the letters acquired a deep tinge, in others a slight one. "Hence," says the doctor, "it is evident that one of the ingredients was iron, which there is no reason to doubt was joined with the vitriolic acid; and the colour of the more perfect manuscripts, which in some was a deep black, and in others a purplish black, together with the restitution of that colour in those which had lost it by the infusion of galls, sufficiently proved that another of the ingredients was astringent matter, which from history appears to have been that of galls. No trace of a black pigment of any sort was discovered; the drop of acid, which had completely extracted a letter, appearing of an uniform pale and ferruginous colour, without an atom of black powder, or other extraneous matter, floating in it."

In considering the methods of restoring the legibility of decayed writings, our author observes, that perhaps one of the best may be to join phlogisticated alkali with the calx of iron which remains; because the precipitate formed by these two substances greatly exceeds that of the iron alone. On this subject Dr Blagden disagrees with Mr Bergmann; but to bring the matter to a test, the following experiments were made.

1. The phlogisticated alkali was rubbed in different quantities upon the bare writing. This, in general, produced little effect, though, in a few instances, it gave a bluish tinge to the letters, and increased their intensity; "probably," says the doctor, "where something of an acid nature had contributed to the diminution of their colour." 2. By adding, besides the alkali, a diluted mineral acid to the writing, our author found his expectations fully answered; the letters then changing quickly to a very deep and beautiful blue. It is but of little consequence whether the acid or phlogisticated alkali be first added; though upon further consideration the doctor inclined to begin with the alkali. The reason is, that when the alkali is first put on, the colour seems to spread less, and thus not to hurt the legibility of the writing so much as would otherwise be done. His method is to spread the alkali thin over the writing with a feather, then to touch it as gently as possible upon or nearly over the letters with the diluted acid by means of a feather or bit of stick cut to a blunt point. The moment that the acid liquor is applied, the letters turn to a fine blue, beyond comparison stronger than the original trace of the letter; and by applying a bit of blotting-paper to absorb the superfluous liquid, we may in a great measure avoid the staining of the parchment; for it is this superfluous liquor which, absorbing part of the colouring matter from the letters, becomes a dye to whatever it touches. Care ought, however, to be taken not to allow the blotting-paper to come in contact with the letters, because the colouring matter may easily be rubbed off while soft and wet. Any one of the three mineral acids will answer the purpose effectually. Dr Blagden commonly uses the marine. But whichever of the three is used, it ought to be diluted so far as not to be in danger of corroding the parchment; after which the degree of strength seems not to be a matter of great nicety.

Another method of restoring the legibility of old writings is by wetting them with an infusion of galls in white wine; but this is subject to the same inconvenience with the former, and is besides less efficacious. The doctor is of opinion that the acid of the galls by itself would be better for the purpose than the infusion of the whole substance of them; and he thinks also that a preferable kind of phlogisticated alkali might be prepared either by purifying the common kind from iron as much as possible, or by making use of the volatile alkali instead of the fixed. Mr Astle mentions a method of restoring the legibility of decayed writings; but says that it ought not to be hazarded, lest a suspicion of deceit should arise.

The illegibility of modern manuscripts, compared with those of an earlier date, is a matter of much interest, and has of late excited considerable inquiry. It appears to us, that the greater durability of the colour of the ink in old manuscripts is owing not only to the strength of the ink, but to the quality of the paper and vellum. The strength of the astringent or *tannin* principle is acknowledged on all hands to be that on which the durability of a vitriolic ink chiefly depends. Now that principle is strong not only in old vellum, but it is retained to a considerable extent in old paper made from linen rags. The vellum formerly used was prepared by a tedious process, by which tannin was largely imparted to it in the same manner as to leather; and to this cause old vellum owes its deep brown colour more than to mere age. In like manner, the paper, instead of being bleached, as is now done, with oxymuriatic acid, to *bring up* the colour, as it is called, but, in fact, to destroy the natural colour of the paper, and to deprive it of one of its most valuable qualities, was allowed to retain somewhat of its original *flax* colour, and with its colour a large proportion of the astringent quality on which the tenuity of the paper, as well as its preservative property, depended. On that strong vellum, parchment, and paper, our ancestors wrote with an ink, the component parts of which seem to have been the same as of that now in use; but as they wrote more seldom, and were not in so great haste, as their descendants, they were content to use their ink so *thick*, that the quantity of gum in it was sufficient to hold a very strong mixture of the other ingredients in suspension. This superabundance of gum or glue was not only serviceable in this respect, but it also acted as a varnish, defending the ink from the corrosive action of the atmosphere. Nor were these the only precautions taken. It will be observed, that those writings on vellum which are in the best preservation, are not only of a deep brown shade, and the ink with an apparent *body* of colour, but the *grain* side of the vellum, or that not written upon, is smooth, almost as if it had been burnished. This seems to have been done with animal glue, and afterwards well rubbed. The ink was thus not only preserved from the action of the air on the one side by the varnish incorporated with it, but protected on the other by the polished surface of the parchment.

Taking these circumstances into consideration, and giving them their due weight, we feel convinced that any effectual plan for giving durability to the public records of the kingdom or other deeds of importance, must commence with the improvement of the paper and vellum upon which they are written. This is a matter deserving the attention of government, and the correction of which is within its reach. The books of records kept in the public offices are or ought to be under its superintendence; and the only deeds the preservation of which is of importance are written upon stamped paper, the issue of which is also within the control of the government. By offering premiums for the manufacture of paper in which the tannin or astringent principle is most effectually preserved or introduced, and using proper precautions respecting the ink with which the deeds are written, we can see nothing in the nature or composition of either to prevent us securing at the very least as great a degree of durability as pertains to the early records of the kingdom.

Indian Ink, a valuable black for water-colours, brought from China and other parts of the East Indies, sometimes in large rolls, but more commonly in small quadrangular cakes, and generally marked with Chinese characters. Dr Lewis, from experiments made on this substance, has shewn that it is composed of fine lamp-black and animal glue; and, accordingly, for the preparation of it, he desires us to mix the lamp-black with as much melted glue as is sufficient to give it a tenacity proper for being made into cakes; and these when dry, he tells us, answered as well as those imported from the East Indies, both with regard to the colour and the freedom of working. Ivory-black, and other charcoal blacks, levigated to a great degree of fineness, answered as well as the lamp-black; but in the state in which ivory-black is commonly sold, it proved much too gritty, and separated too hastily from the water.

Red Ink. The red ink in common use for writing or ruling is a decoction of Brazil wood in vinegar, the colour of which is raised by alum. It answers every ordinary purpose of business, but the colour is evanescent, especially on highly bleached paper, the oxymuriatic acid in which turns the ink first of a purple colour and then gradually whitens it. No red ink which will stand exposure to the air has yet been discovered, save a thin pigment of vermilion, with which many old bibles were ruled; but it can easily be washed off.

Blue Ink. The dye commonly called *liquid blue* is frequently used for writing, being, if well made, durable; and when diluted with water forms the ink with which the *faint lines* in ruling are drawn. It is made of indigo dissolved in sulphuric acid, the strength of the acid being afterwards reduced by throwing into the liquid mass pieces of chalk or of an alkali.

For other coloured inks see *Colour Making*.

Printing Ink, is totally different from Indian ink, or that made use of in writing. It is an oily composition, of the consistence of an ointment. The method of preparing it was long kept a secret by those whose employment it was to make it, and who were interested in concealing it; and even yet it is but imperfectly known. The properties of good printing ink are, to work clean and easily, without daubing the types or tearing the paper; to have a fine black colour; to wash easily off the types; to dry soon; and to preserve its colour, without turning brown. This last, which is a most necessary property, is effectually obtained by setting fire to the oil with which the printing ink is made for a few moments, and then extinguishing it by covering the vessel.[1] It is made to wash easily off the types, by using soap as an ingredient; and its working clean depends on its having a proper degree of strength, which is given by a certain addition of rosin. A good deal, however, depends on the proportion of the ingredients to each other; for if too much soap is added, the ink will work very foul, and daub the types to a greater degree. The same thing will happen from using too much black, at the same time that both the soap and black hinder the ink from drying; whilst too much oil and rosin tear the paper, and hinder it from washing off. The following receipt has been found to make printing ink of a tolerable good quality: Take a Scotch pint of linseed oil, and set it over a pretty brisk fire in an iron or copper vessel capable of holding three or four times as much. When it boils strongly, and emits a thick smoke, kindle it with a piece of paper, and immediately take the vessel off the fire. Let the oil burn for about a minute; then extinguish it by covering the vessel; after it has grown pretty cool, add two pounds of black rosin, and one pound of hard soap cut into thin slices. If the oil is very hot when the soap is added, almost the whole mixture will run over the vessel. The mixture is then to be set again over the fire; and when the ingredients are thoroughly melted, a pound of lamp-black, previously put through a lawn sieve, is to be stirred into it. The whole ought then to be ground on a marble stone, or in a levigating mill.

Though the above receipt is greatly superior to any that has been hitherto published, all of which are capitally deficient in not mentioning the necessary ingredients of rosin and soap; yet it must be acknowledged that ink made in this manner is inferior in point of colour, and is likewise more apt to daub the types and make an indistinct impression, than such as is prepared by some of those who make the manufacture of this commodity their employment; so that either a variation in the proportion of the ingredients, a nicety in the mixture, or some additional ingredient, seems necessary to bring it to the requisite perfection.

Ink for the rolling Press, is made of linseed oil burned in the same manner as that for common printing ink, and then mixed with Francfort-black, and finely ground. There are no certain proportions which can be determined in this kind of ink; every workman adding oil or black to his ink as he thinks proper, in order to make it suit his own taste. Some, however, mix a portion of common boiled oil, which has never been burned; but this must necessarily be a bad practice, as such oil is apt to go through the paper; a fault very common in prints, especially if the paper is not very thick. No soap is added; because the ink is not cleared off from the copperplates with alkaline ley as in common printing, but with a brush dipped in oil.

Lithographic Ink. The ink used for writing or drawing in lithography is described under that article. For printing ink to be used in lithography, prepare a varnish or varnishes, of various degrees of tenuity, by boiling and burning old linseed oil in an iron pot with a closely fitting metal cover. When the varnish is of the thickness required, throw in some pieces of stale bread to absorb the fatty matter. Into this varnish, when cold, grind lamp-black or Francfort-black, adding a little indigo and rose-pink, which give depth to the black. It must be ground until so fine that no particles are observed on turning it over with a palette knife. For blue, use indigo; for red, vermilion.

Sympathetic Ink, a liquor with which a person may write, and yet nothing appear on the paper after it is dry, till some means are used, as holding the paper to the fire, or rubbing it over with some other liquor, to make it visible.

These kinds of ink may be divided into seven classes, with respect to the means used to make them visible, viz. 1. such as become visible by passing another liquor over them, or by exposing them to the vapour of that liquor; 2. those that do not appear so long as they are kept close, but soon become visible on being exposed to the air; 3. such as appear by strewing or sifting some very fine powder of any colour over them; 4. those which become visible by being exposed to the fire; 5. such as become visible by heat, but disappear again by cold or the moisture of the air; 6. those which become visible by being wetted with water; and, 7. such as appear of various colours.

The first class contains four kinds of ink, viz. solutions of lead, bismuth, gold, and green vitriol, or sulphate of iron. The two first become visible by the contact of sulphureous liquids or fumes. For the first, a solution of common sugar of lead in water answers very well. With this solution write with a clean pen, and the writing when dry will be totally invisible; but if it be wetted with a solution of

[1] This is mentioned by Dr Lewis in his *Philosophical Commerce of Arts*; but he seems not to have been acquainted with the method of giving it the other necessary properties.

hepar sulphuris, or of orpiment, dissolved by means of quicklime, or exposed to the strong vapours of these solutions, the writing will appear of a brown colour, more or less deep, according to the strength of the sulphureous fume. By the same means the solution of nitrate of bismuth will appear of a deep black.

The sympathetic ink prepared from gold depends on the property by which that metal precipitates from its solvent on the addition of a solution of tin. Write with a solution of gold in nitro-muriatic acid, and let the paper dry gently in the shade; nothing will appear for the first seven or eight hours. Dip a pencil in the solution of tin, and draw it lightly over the invisible characters, they will immediately appear, of a purple colour.

Characters written with a solution of green vitriol will likewise be invisible when the paper is dry; but if wetted with an infusion of galls, they will immediately appear as if written with common ink. If, instead of this infusion, a solution of an alkaline prussiate be used, the writing will appear of a deep blue.

To the second class belong the solutions of all those metals which are apt to attract oxygen from the air, such as lead, bismuth, silver, &c. The sympathetic ink of gold already mentioned belongs also to this class; for if the characters written with it are long exposed to the air, they become by degrees of a deep violet colour, nearly approaching to black. In like manner, characters written with a solution of nitrate of silver are invisible when newly dried, but being exposed to the sun, appear of a gray colour like slate. To this class also belong solutions of sugar of lead, nitrates of copper and of mercury, acetate of iron, and muriate of tin. Each of these has a particular colour when exposed to the air; but they corrode the paper.

The third class of sympathetic inks contains such liquids as have some kind of glutinous viscosity, and at the same time are long in drying; by which means, though the eye cannot discern the characters written with them upon paper, the powders strewed upon them immediately adhere, and thus make the writing become visible. Of this kind are urine, milk, the juices of some vegetables, weak solutions of the deliquescent salts, and other liquids.

The fourth class, comprehending all those that become visible by being exposed to the fire, is very extensive, as it contains all those colourless liquids in which the matter dissolved is capable of being reduced, and of reducing the paper into a sort of charcoal by a small heat. Sulphuric acid, diluted with as much water as will prevent it from corroding the paper, makes a good ink of this kind. Letters written with this fluid are invisible when dry, but instantly on being held near the fire appear as black as if written with the finest ink. Juice of lemons or onions, a solution of sal ammoniac, green vitriol, &c. answer the same purpose.

The fifth class comprehends only a solution of muriate of cobalt.

The sixth class comprehends such inks as become visible when characters written with them are wetted with water. They are made of all such substances as deposit a copious sediment when mixed with water, dissolving only imperfectly in that fluid. Of this kind are dried alum, sugar of lead, vitriol, and other substances. We have therefore only to write with a strong solution of these salts upon paper, and the characters will be invisible when dry; but when we apply water, the small portion of dried salt cannot again be dissolved in the water. Hence the insoluble part becomes visible on the paper, and shews the characters written in white, gray, brown, or any other colour which the precipitate assumes.

Lastly, characters may be made to appear of a fine crimson, purple, or yellow, by writing on paper with solution of muriate of tin, and then passing over it a pencil dipt in a decoction of cochineal, Brazil-wood, log-wood, yellow-wood, or the like.

A treatise upon inks was published by Peter Caniparius, professor of Medicine at Venice, of which an edition was printed at London in 1660. It is divided into six parts. The first treats of inks made from pyrites, stones, and metals; the second of such as are made from metals and calces; the third of those which are prepared from soots and vitriols; the fourth of the different kinds of inks used by the *librarii* or book-writers, by printers, and engravers: likewise of staining or writing upon marble, stucco, or scagliolia, and of encaustic modes of writing; of liquids for painting or colouring leather and linen or woollen cloth, and of restoring inks that had been decayed by time; together with many methods of effacing writing, restoring decayed paper, and different modes of secret writing. The fifth treats of writing inks made in different countries from gums, woods, the juices of plants, and the like, as well as of different kinds of varnishes. The sixth treats of the different methods of extracting vitriol, and the chemical uses of it.

Weckerus, in a treatise *de Secretis*, printed at Basil in 1612, contains a number of curious particulars concerning ink. He also gives receipts for making gold and silver inks, composed both with these metals and without them; and directions for making inks for secret writing, and for effacing them, though in this last part there are many particulars bordering too much on the marvellous.

INK *Stones*, a kind of small round stones, of a white, red, gray, yellow, or black colour, containing a quantity of native martial vitriol, from which they derive the property of making ink, and hence their name. They are almost entirely soluble in water, and besides their other ingredients, contain also a portion of copper and zinc.

INLAND, a name for any part of a country at a distance from the coast.

INLAND *Navigation*. See NAVIGATION, INLAND.

INLEASED, in our old writers, signifies entangled or ensnared. It is a term used in the champion's oath.

INMATES, such persons as are admitted for their money to live in the same house or cottage with another person, in different rooms, but entering by the same door; being usually supposed to be poor, and not able to maintain entire house themselves.

INN, or INNVERTE, a circle of the Austrian province of the Upper Ens, extending over 1308 square miles, containing 5 cities, 26 market towns, and 3688 villages and farms, with 37,236 houses, and 181,633 inhabitants.

INN, a place appointed for the relief and entertainment of travellers.

INNS. Our colleges of municipal or common law professors and students, are called *inns;* this being the old English word for houses of noblemen, bishops, and others of extraordinary note, and of the same signification with the French word *hotels.*

INNS *of Court* are so called, according to some, because the students there are to serve and attend the courts of judicature; or because these colleges anciently received none but the sons of noblemen, and the better sort of gentlemen, who, as Fortescue affirms, were to be there qualified to serve the king in his court. In the time of Fortescue, there were about two thousand students in the inns of court and chancery, all of whom were *filii nobilium*, or gentlemen born. But this custom gradually fell into disuse; so that in the reign of Queen Elizabeth, Sir Edward Coke does not reckon above one thousand students, and the number at present is very considerably less. For this Judge Blackstone assigns the following reasons: 1. Because the inns of chancery, being now almost totally filled by the inferior branches of the profession, are neither commodious nor proper for the resort of gentlemen of any rank or figure; so that there are very rarely any young students entered at the inns of chancery. 2. Because in the inns of court all sorts of regimen and academical superintendence, either with regard to morals or studies, have been found impracticable, and therefore entirely neglected. 3. Because persons of birth and fortune, after having finished their usual courses at the universities, have seldom leisure or resolution sufficient to enter upon a new scheme of study at a new place of instruction; wherefore few gentlemen now resort to the inns of court, except those for whom the knowledge of practice is absolutely necessary in such as are intended for the profession.

Our inns of court, justly famed for the production of men of learning in the law, are governed by masters, principals, benchers, stewards, and other officers; and they have public halls for exercises, readings, and the like, which the students are obliged to attend for a certain number of years, before they can be admitted to plead at the bar. These societies have not, however, any judicial authority over their members; but instead of this there exist among themselves certain orders or regulations, which have by consent the force of laws. For lighter offences persons are only excommoned, or put out of commons; for greater, they lose their chambers, and are expelled the college; and when once expelled out of one society, they are never received by any of the others. The gentlemen in these societies may be divided into benchers, outer-barristers, inner-barristers, and students.

The four principal inns of court are, the Inner Temple and Middle Temple, formerly the dwelling of the Knights Templars; and Lincoln's Inn and Gray's Inn, which anciently belonged to the Earls of Lincoln and Gray. The other inns are the two Serjeants' Inns.

INNS *of Chancery* were probably so called, because anciently inhabited by such clerks as chiefly studied the forming of writs, which regularly belonged to the cursitors, who are of chancery.

The first of these is Thavies Inn, begun in the reign of Edward III., and afterwards purchased by the society of Lincoln's Inn. Besides this, there are New Inn, Symond's Inn, Clement's Inn, Clifford's Inn, Staple Inn, belonging to the merchants of the staple; Lion's Inn, anciently a common inn with the sign of the lion; Furnival's Inn, and Bernard's Inn.

Heretofore these were preparatory colleges for younger students; and many were entered there, before they were admitted into the inns of court. Now they are mostly occupied by attorneys, solicitors, and others. They all belong to one or other of the inns of court, who formerly used to send yearly some of their barristers to read to them.

INNATE IDEAS, those ideas supposed to be stamped on the mind from the first moment of its existence, and which it brings into the world with it; a doctrine which Mr Locke has taken great pains to refute. See METAPHYSICS.

INNISFAIL (formed from *Innis Bheal*, the island of Bheal), one of the ancient names of Ireland, which is so denominated from *Bheal* or *Baal*, the principal object of adoration amongst the ancient inhabitants of the British isles. Innisfail has been translated the *Island of Destiny*, because *Bheal* was sometimes taken for *Fate* or *Providence*.

INNISFALLEN, an island in the lake of Killarney, in the county of Kerry, and province of Munster, containing the ruins of a very ancient religious house, founded by St Finian, the patron saint of these parts, to whom the cathedral of Aghadoe is also dedicated. The remains of this abbey are very extensive, and its situation is retired and romantic.

INNISHANNON, a town in the county of Cork, and province of Munster, 134 miles from Dublin, and situated on the river Bandon, six miles from Kinsale. The river is navigable to Collier's Quay, about half a mile below the place. This place was formerly walled, and of some note. The town of Innishannon, together with its ferry, were granted to Philip de Barry by letters patent from Henry V. in 1412.

INNISHIRKAN, an island situated between Cape Clear Island and Baltimore Bay, in the county of Cork, and province of Munster. In this island stood the castle of Dunelong, possessed by the O'Driscolls, which was surrendered to Captain Harvey on the 23d of February 1602, after the defeat of the Spaniards. There was afterwards a regular fortification erected on part of the island, which was garrisoned in Queen Anne's time, but it has long been dismantled. About a mile to the south are the remains of an ancient abbey, founded 1460, for Franciscans, by Florence O'Driscoll.

INNISKILLING, INNISKILLEN, a borough town of Ireland, in the county of Fermanagh, and province of Ulster, situated between three lakes. It is about twenty-four miles east of Ballyshannon, and seventy-nine north-west of Dublin, this place giving title of viscount to the family of Cole. Its inhabitants distinguished themselves in several considerable engagements in the wars of Ireland at the Revolution, and of their number, a regiment of dragoons, bearing the title of the Inniskillen Dragoons, was mostly formed. This regiment is the sixth of dragoons in the British army.

INNOCENTS' DAY, a festival of the Christian church, observed on the 28th of December, in memory of the massacre of the innocent children by the command of Herod king of Judæa.

INNUENDO (from *innuo*, I nod or beckon), is a word frequently used in writs, declarations, and pleadings, to ascertain a person or thing which was named before, but left doubtful, as, he (*innuendo*, the plaintiff) did so and so; mention being before made of another person. In common conversation or writing, an innuendo denotes an oblique hint or distant reference, in contradistinction to a direct and positive charge.

INNYCOTTA, a town of Hindostan, province of Berar, in the province of Gundwana, situated upon the eastern bank of the Warda river, 57 miles S. W. from Nagpoor. Lat. 20° 35′ N; Long. 79° 10′ E.

INO, in fabulous history, a daughter of Cadmus and Harmonia, who nursed Bacchus. She married Athamas, king of Thebes, after he had divorced Nephele, by whom he had two children, Phryxus and Helle. Ino became mother of Melicerta and Learchus; and soon conceived an implacable hatred against the children of Nephele, because they were to ascend the throne in preference to her own. Phryxus and Helle were informed of Ino's machinations, and escaped to Colchis on a golden ram. Juno, jealous of Ino's prosperity, resolved to disturb her peace; and more particularly because she was a descendant of her greatest enemy Venus. Tisiphone being sent by order of Juno to the house of Athamas, she filled the whole palace with such fury, that Athamas, taking Ino to be a lioness and her children whelps, pursued her and dashed her son Learchus against a wall. Ino escaped the fury of her husband, and from a high rock threw herself into the sea, with Melicerta in her arms. The gods pitied her fate; and Neptune transformed her into a sea deity, afterwards denominated Leucothoe. Melicerta also became a sea god, and was known by the name of Palemon.

INOA, festivals in memory of Ino, celebrated yearly with sports and sacrifices at Corinth. An anniversary sacrifice was also offered to Ino at Megara, where she was first worshipped under the name of Leucothoe. Another festival of the same description was also celebrated in Laconia, in honour of the same goddess.

INOCULATION, or BUDDING, in *Gardening*. See HORTICULTURE.

INOCULATION, in a physical sense, is used to indicate the transplantation of distempers from one subject to another, particularly for the engraftment of the small-pox; a practice which, though of ancient use in eastern countries, is but of modern date amongst us, at least under the direction of art. See SURGERY and VACCINATION.

The time and place in which the method of inoculating for the small-pox was first used, are equally unknown. Accident probably gave rise to it. Pylarini says, that amongst the Turks it was not attended to, excepting amongst the meaner sort. Dr Russell informs us[1] that no mention is made of it by any of the ancient Arabian medical writers who are known in Europe; and the native physicians of Arabia assert, that nothing is to be found regarding it in any of those of a more modern date. He further says, that he engaged some of his learned Turkish friends to make inquiry concerning this matter; but they did not discover any thing on the subject of inoculation in the writings of their physicians, historians, or poets. Until the beginning of the eighteenth century, all the accounts we have of inoculating the small-pox are merely traditional. The silence on this subject observed amongst writers in the countries where the practice obtained, Dr Russell supposes, with great probability, to be owing to the circumstance that the physicians there never countenanced or engaged in it. It is also remarkable, that before Pylarini's letter to the Royal Society in 1701, and for several years afterwards, this practice is not noticed by any of the most inquisitive travellers. On this Dr Russell very justly observes, that customs the most common in distant countries are often the least apt to attract the observation of travellers, who, engaged in other pursuits, are indebted to accident for the knowledge of such things as the natives seldom talk of, from a belief that they are known to all the world.

The first accounts we have concerning inoculation, are from two Italian physicians, Pylarini and Timoni, whose letters on the subject may be consulted in the *Philosophical Transactions* abridged (vol. v. p. 370). The first is dated in 1701, the second in 1713. But whether our inquiries extend to countries abroad, or are confined to our own, inoculation, in one mode or other, has been practised from time immemorial; in Great Britain and its adjacent isles we have well authenticated accounts, extending farther backwards than any we have received from the continent. Dr Williams of Haverfordwest, who wrote upon inoculation in 1725, proves that it had been practised in Wales, though in a somewhat different form, time out of mind. Mr Wright, a surgeon in that principality, says, that *buying the small-pox* is both a common practice, and of long standing, in that neighbourhood. He mentions, that in Pembrokeshire there are two large villages near the harbour of Milford, more famous for this custom than any other, namely, St Ishmael's and Marloes. The old inhabitants of these villages say, that it has been a common practice; and that one William Allen of St Ishmael's, who was ninety years of age in 1722, declared to some persons of good sense and integrity, that this practice was used all his time, and that he well remembered his mother telling him that it was a common practice all her time, and that she got the small-pox by inoculation.

Dr Alexander Monro senior informs us, that in the Highlands of Scotland and some of the adjacent isles, the custom through ages had been, to put their children to bed with those who laboured under a favourable small-pox, and to tie worsted threads about their children's wrists, after having drawn them through variolous pustules.

According to the result of Dr Russell's inquiries, the Arabians asserted that the inoculation of the small-pox was the common custom of their ancestors, and that they had no doubt of its being as ancient as the disease itself. It is remarkable, that *buying the small-pox* is the name universally applied in all countries to the method of procuring the disease. It is true that there are other terms; but in Wales and in Arabia, as well as in many other countries, this is the usual appellation. From the identity of the name, and the little diversity observable in the manner of performing the operation, it is probable that the practice of inoculation in these countries was originally derived from the same source. It is also in all probability of great antiquity.

In the year 1717, Lady Mary Wortley Montague, wife of the English ambassador at Constantinople, had her son inoculated there at the age of six years; he had but few pustules, and soon recovered. In April 1721, inoculation was successfully tried upon seven condemned criminals in London, by permission of his Majesty. In 1722, Lady Mary Wortley Montague had a daughter six years old inoculated in this island; soon after which, the children of the royal family who had not had the small-pox were inoculated with success; then followed some of the nobility, and the practice soon became general. And here we date the commencement of inoculation under the direction of art.

INQUISITION, in the Church of Rome, a criminal tribunal, charged with the detection, prosecution, and punishment of heresy, apostasy, and other crimes against religion.

This formidable jurisdiction, created for the express purpose of repressing free inquiry in matters of religion, and maintaining the unity of the faith, was first instituted about the beginning of the thirteenth century, when Innocent III. appointed a commission to prosecute and punish the heretics of Narbonne. In 1203, the Pope employed Pierre de Castelnau and Raoul, monks of Cîteaux, attached to the monastery of Frontfroine in Narbonne, to preach against the heresy of the Albigenses. The labours of these missionaries were not altogether fruitless, as is proved by an authentic act which William Castel has inserted in his History of the Counts of Toulouse, and which was agreed to in the year 1204. They appear to have made a considerable impression, and, in particular, to have induced the inhabitants of Toulouse to bind themselves by an oath to maintain the Catholic religion, and to combat heresy by every means in their power. The success which Castelnau and Raoul had thus obtained in their mission, encouraged the Pope to put in execution a project which he had formed for introducing into the Catholic Church inquisitors independent of the bishops, who should, as delegates of the Holy See, have the right of prosecuting heretics.

With this view he named as apostolic legates, the Abbot of Cîteaux, and the two monks Castelnau and Raoul, who received orders to take the necessary measures for bringing back heretics to the Catholic faith, and also for delivering to the secular power, after excommunication, those who refused submission; a penalty which involved the seizure of their goods, and the proscription of their persons. And, in order to facilitate the execution of his design, he solicited Philip II., king of France, his oldest son Louis, and the counts, viscounts, and barons of the kingdom, to prosecute heretics of whatsoever rank they might be, and to seize the goods of all persons who might be convicted of favouring heresy, or who had not laboured to destroy it; promising them, as a recompense for their zeal, plenary indulgences, similar to those granted to the Christians who had assumed the cross, and repaired to the Holy Land to combat against the Infidels. But the papal legates experienced great difficulties in the execution of their mission, which was distasteful to the bishops; the king of France took no part in the affair; and the Counts of Toulouse, Foix, Beziers, Carcassonne, and other seigneurs or great lords of the provinces, seeing that the Albigenses had singularly multiplied, and

[1] *Philosophical Transactions*, vol. lviii. p. 142.

persuaded that only a very small number of them would freely consent to abjure their opinions, refused to expel a body of men, the loss of whom would weaken the population of their estates, and consequently prove injurious to their interests. Nor was the force of this motive lessened by the consideration that these heretics were generally peaceable and obedient subjects. The legates were consequently discouraged, and one of their number applied to the Pope for permission to retire to his monastery. But the Holy Father, firm to his purpose, exhorted him to prosecute the enterprise with new ardour, and at the same time addressed new briefs to Philip II., reproaching him for his indifference, and to the Archbishop of Narbonne and to the Bishop of Beziers, censuring the mode in which they had acted towards his legates.

In these circumstances, Castelnau and Raoul commenced preaching to the heretics, and even held conferences with some of their leaders; but, as might have been expected, the number of persons converted by them was exceedingly small. Arnauld, Abbot of Cîteaux, the principal legate, then summoned to his assistance twelve abbots of his order, elected by a chapter held in 1206, and also admitted to a participation of their labours two Spaniards, whose zeal prompted them to preach against the heretics, and one of whom became afterwards celebrated as the founder of a new order in the Catholic Church. These were Diego Acebes, Bishop of Osma, who was then on his return from Rome to his diocese, and Dominic de Guzman, a regular canon of St Augustin, and sub-prior of the cathedral of the same diocese, who had accompanied the bishop in his journey. With a staff thus reinforced, some conversions were made, and when the Spanish bishop resolved to cross the frontier, he permitted De Guzman to remain in France.

At this time the great feudatories of Provence and Narbonne were almost all engaged in war with each other; and hence when the legates sent by the Pope summoned them to prosecute obstinate heretics in their states, they represented that they could not execute the orders of his Holiness, by reason of the wars which they were obliged to maintain against their neighbours. Innocent III., informed of what was passing, issued a formal order to his legates, commanding them to terminate, by their mediation, the differences which had armed the princes and great lords of this country, and to make the latter promise upon oath, to extirpate heresy, and to exterminate heretics in their domains. Nor were the legates unfaithful to the instructions which they had received. They threatened to excommunicate those who should refuse obedience to the orders of the Holy See; to lay their principalities under interdict; to release their vassals from their oath of fidelity; and, in a word, to punish them by all the means which the church had or claimed a right to employ against rebels. The effect of this measure was decisive; and the great lords, dreading evils still greater than those of war, renounced for the time their different pretensions, and consented to sign a peace. Of these princes the most powerful was Raymond VI., Count of Toulouse. Having been several times menaced by Pierre de Castelnau, because he hesitated to execute what he had promised, and failed to reinforce the predications of the legate by proscription and confiscation, the proud noble let fall some expressions of resentment. His words were treasured up by those who had deeper wrongs to avenge, and falling in with the feeling of indignation excited by the insolent conduct of the churchman, they induced the Albigenses to assassinate the legate. The latter was beatified, and enrolled amongst the martyrs of the church, sooner perhaps than he had anticipated; but the perpetrators of the crime were destined ere long to taste its bitter fruits. Meanwhile the Pope wrote to all the counts, barons, seigneurs, and gentlemen of the provinces of Narbonne, Arles, Embrun, Aix, and Vienne in Dauphiné, urging them to unite their forces and to march against these heretics, and promising them the same indulgences as if they had been called to combat against the Saracens. In this expedition, Innocent named as his legate the Bishop of Couserans, who was to be accompanied by the Abbot of Cîteaux.

The commencement of the Inquisition in France dates from the war undertaken against the Albigenses, and their protector Raymond VI., Count of Toulouse, in 1208. The murder of Castelnau having excited the indignation of the Catholics of Narbonne, Arnauld took advantage of this feeling, to put in execution the orders which he had received from the Pope. He charged the twelve monks of his order who were associated with him, besides Dominic de Guzman, and certain other priests, to preach a crusade against the heretics; to grant indulgences to all who should take part in the war; to take especial notice of those who might refuse to engage in it; to inform themselves particularly as to the creed of such recusants; and to cause the obstinate to be placed at the disposal of Simon, Count de Montfort, who had been entrusted with the command of the crusaders. The authentic act by which these measures were ordained, has not reached our time; but its existence is proved generally by the events of that epoch, and, in particular, by a certificate of reconciliation granted by Dominic de Guzman to a heretic named Ponce Roger, in which the founder of the Dominicans declared that he acted as the delegate of the Abbé Arnauld.

It is not easy to determine the number of the unfortunate Albigenses who perished in the flames after 1208, the year in which the Inquisition commenced in France. But it is impossible not to be strongly moved with horror as well as compassion, in reading the histories of the time, which represent the destruction of several millions of persons, in the midst of the most cruel torments, as the triumph of a religion on which its divine Founder had impressed the characters of humanity and charity, benevolence and mercy. The apostles, upon one occasion, entreated their divine Master to cause fire to descend from heaven and consume the Samaritans, who were the heretics and schismatics of the Hebrew communion; but, so far from complying with their impious request, he reproached them for entertaining the very thought, and made them feel that he detested it, by treating them with a degree of severity of which there is no other example to be found in the Gospel. This lesson, however, was lost upon the men of the thirteenth century. They seem to have conceived that the history of Samaria had nothing in common with the conduct which ought to be pursued towards the heretics of that age. In 1215, Innocent III. celebrated the tenth general council, being the fourth of Lateran, in which a variety of new penalties were decreed against the heretics of Languedoc. In particular it was ordained, that those who were condemned by the bishops as impenitent heretics should be delivered to secular justice; that the goods of laymen condemned should be confiscated, and those of priests applied to the use of their churches; that the inhabitants suspected of heresy should be summoned to purge themselves in the canonical form, and, in case of refusal, excommunicated; that if they continued more than a year under the anathema, without having recourse to the pardon of the church, they should be accounted heretics, and treated as such; that all persons who favoured or received into their houses heretics, should be liable to excommunication as well as the heretics themselves,—declared infamous, and as such excluded from all public employments,—deprived of the right of electing their own magistrates,—and rendered incapable of giving evidence in a court of justice, making testamentary dispositions, or taking up any succession, if at the expiration of a year they had failed to perform their duties and satisfy the church.

Pope Innocent III. died on the 12th of July 1216, and two days thereafter was succeeded by Honorius III., who resolved to continue the work which his predecessor had commenced. The new pontiff approved of the institution founded by Dominic de Guzman, according to the rule of St Augustin, and having for its object to preach against the heretics; an institution which gave rise to the order of preaching friars, who were afterwards termed Dominicans. He wrote to Guzman, praising his zeal, and encouraging him to persevere in the enterprise in which he had engaged; he sent into the provinces of Languedoc and Provence, Cardinal Bertrand, with the title of legate, the principal object of whose mission was to prosecute with new vigour the war against the Albigenses, to sustain the zeal of the missionaries, and to ensure the reconciliation of converted, as well as the punishment of obstinate heretics; and, lastly, he issued a brief addressed to all the bishops of Christendom, strongly recommending to their favour and support the order of preaching friars.

Meanwhile St Dominic, who happened to be at Rome, had instituted an order for seculars who lived in the world, the members of which were to be bound to assist, as far as they could, those who preached against heresies, and to prosecute heretics with unrelenting rigour. This order has sometimes been designated the Third Order of Penitence, but it was more commonly denominated the Militia of Christ, because those who entered it were required to combat heretics, and to aid the inquisitors in the exercise of their ministry. They were in fact regarded as forming part of the family of the inquisition, and, for this reason, they bore the name of *Familiars.* Here, then, we have the two great elements of the Holy Office; first, the institution of St Dominic, or the order of preaching friars, called Dominicans; and, secondly, the Militia of Christ, an association which afterwards gave rise to that which was known under the name of the Congregation of St Peter Martyr; two orders which were soon confounded, and the members of which were denominated *Familiars of the Holy Office of the Inquisition.*

Nor was it long ere the tribunal, thus organized, commenced active operations against heretics. In 1224, the Inquisition had been established in Italy, under the direction of the religious Dominicans. This is proved by a constitution of Frederick II., published at Padua in February 1224, which provided that heretics condemned as such by the church, and delivered over to the secular arm, should be punished in a manner proportioned to their crime; that whosoever, through fear of punishment, might be brought back to the unity of the faith, should be subjected to a canonical penance and shut up in prison for life; that the inquisitors established by the pope, or Catholics zealous for the purity of the faith, might require judges, in any part of the empire, to cause heretics to be seized, and detained as prisoners until, after being formally excommunicated by the church, they were judged and punished with death; that all who supported or protected heretics should undergo the same punishment; that heretics who had returned into the bosom of the church should be obliged to pursue those persons charged with heresy, discover, and bring them before the Inquisition; that he who, having made abjuration *in articulo mortis*, should relapse into heresy after recovering his health, should equally suffer a capital punishment; and that treason against God was a much greater crime than treason against man. This constitution contains other provisions equally severe, and concludes by declaring that all those who should concur with the new religious order in delivering the empire from the contagion of heresy, would serve God and render themselves useful to the state. It appears, however, that the efforts of the Inquisition in Narbonne, were not attended with the success which the Pope had expected from them, probably because the events of the war were not always favourable to the crusaders.

But it was reserved for Gregory IX., who ascended the pontifical throne in 1227, to fix the establishment of the Inquisition in the form of a tribunal, and at the same time to give it constitutions. With this view he convened a council at Toulouse, where new measures of severity were adopted against the heretics; he also issued a bull excommunicating them, and further, enjoining that the impenitent should be delivered over to the secular arm, and that all their supporters and adherents should be declared infamous. He next transmitted a brief to Esparrago, archbishop of Toledo, exhorting him to combat heresy; and at the same time addressed to the prior of the Dominicans of Lombardy a commission, confiding to that religious order the execution of his bull against heretics. Councils were also held at Melun, and at Beziers, where new regulations were adopted for preserving the purity of the faith, by multiplying the severities against those by whom it was denied.

But whilst this was passing in France, the heresy of the Albigenses penetrated even into the capital of the Catholic world. The extreme means of repression hitherto employed against these schismatics had totally failed either in lessening their ardour, or in abating their enthusiasm. Several thousands of their number had perished at the stake in France and Italy; yet, so far from being discouraged, they had, in defiance of the power of the Pope, carried their doctrines into his very capital, and, by this conduct, proved how much they disregarded the anathemas of the church, and even the horrible torments with which Gregory had menaced them. Nor is it improbable that the pontiff would have abandoned the system of repression which he had adopted, if the opinions which originated in the fourth century, when Constantine embraced Christianity, had not from age to age acquired a new degree of force; namely, that sufficient reasons might be discovered in the Gospel for punishing heretics with death. Unhappily, however, men's minds, subjugated by prejudice, and inflamed by bigotry, were rendered incapable of considering objects in their true light. Hence, so far from changing his system, or taking as his guide that spirit of meekness and benevolence which had distinguished the first three centuries of Christianity, Gregory fulminated against the heretics a bull in which he excommunicated all those belonging to certain classes that are therein named; ordained that the persons condemned should be delivered over to the secular power to receive the punishment due to their crime; regulated the mode of procedure to be adopted against persons accused of heresy; intercommuned, declared infamous, and deprived of their civil rights, those inhabitants who should receive into their houses, protect, or defend reputed heretics; and provided that if any one desired to recant and renounce his errors, he should undergo such penance as might be prescribed, and thereafter be imprisoned for life. This bull, which contained many other penalties and disabilities, was enforced with the utmost rigour; whilst the senator Annibal, and other members of the government of Rome, in order to second the Pope in the execution of the measures which he had ordained, passed different municipal laws, having for their object the detection and punishment of heretics, and being in spirit and character nearly the same with those which had been promulgated by Frederick II.

Nor were these regulations confined in their operation to Rome. They were transmitted, along with those which Gregory himself had decreed, to the Archbishop of Milan, in order that he might cause them to be rigorously executed in his own diocese, in those of his suffragans, and in some other parts of Cisalpine Gaul, where heresy had already made alarming progress. Frederick II. also renewed the constitutions which he had published against heretics in 1224, particularly the law against blasphemers, which condemned all heretics indiscriminately to undergo the punishment of burning, or of having the tongue cut out, if the bishops thought proper to shew them mercy, in order that in future it might be impossible for them to blaspheme the holy name of God.

Such is the general form which the Inquisition had assumed in France and Italy, when Gregory IX. introduced it into Spain. This event took place about the middle of the thirteenth century. Spain was then divided into four Christian kingdoms, viz. Castille, Navarre, Aragon, and Portugal, besides the Mahommedan States; but, with relation to the Inquisition, that country was, in 1301, divided into two provinces, viz. those of Castille and Aragon. To the Dominicans, who had hitherto acquitted themselves with success in the ministry of persecution, Gregory confided the execution of the bull by which the Inquisition was established in Spain; and, at a subsequent period, the provincial of this order had conferred upon him the right of nominating the local inquisitors, with the title and rank of provincial of Spain. Nor was it long ere this formidable institution, having for its object to extirpate heresy, and to preserve the purity of the Catholic faith, came into active operation. For the details of its proceedings, however, we must refer the reader to the work of Llorente,[1] which, with all its faults of style and arrangement, contains a vast body of interesting and authentic information on this subject. We shall only remark here, that never did plant find a more congenial soil. In France and in Italy it had required strenuous and persevering efforts to organize and establish this terrible tribunal; in Spain, however, it took root at once, and in time attained a magnitude which, from a variety of causes, it never reached in any other country. During the fourteenth century its progress was steady, whilst its vigour and energy were continually on the increase. Its jurisdiction was enlarged, and its ramifications multiplied; *autos-da-fe* were celebrated in various places; and many perished in the flames, or were condemned to suffer punishments of greater or less severity, for asserting the unalienable rights of conscience.

But it was not until towards the close of the fifteenth century, when Isabella, wife of Ferdinand of Aragon, had ascended the throne of Castille, and when the different kingdoms of Spain were united under these sovereigns, that the Inquisition became general in that country, and assumed that form which it retained until the period of its dissolution in 1808. The execution of the bull of Sixtus IV., which authorized Ferdinand and Isabella to establish the Inquisition in their states, was indeed for a time suspended; but this suspension must have been of short duration, for in 1480 and 1481 we find it in full activity. Severe measures were adopted against the Jews, who were accused of the most absurd and ridiculous crimes, and in consequence the new Christians, as they were called, emigrated in great numbers. The flames of persecution raged at Seville, where, in 1481, twenty-six persons perished at the stake; and already no less than two hundred and ninety-eight victims had shared a similar fate. From this period, indeed, may be dated the establishment of the modern Inquisition, that is, of the Inquisition such as it existed even until our own time. This was effected by the creation of a grand inquisitor-general; the appointment of a royal council of the Inquisition, afterwards denominated the Council of the Supreme; the institution of subaltern tribunals in all parts of the kingdom; and, lastly, the enactment of organic laws, having for their object to give stability to the tribunal, as well as uniformity to its procedure, and efficacy to its exertions in the repression of heresy. By this organization there was created in Spain a jurisdiction in matters of religion, which, under the able but merciless direction of such men as Torquemada, Valdez, and their immediate successors, became the most effective and vigorous engine of persecution which had ever before been known in any age or country. Its character will be best understood by stating the substance of the organic or fundamental laws of the modern Inquisition, which, under the name of *Instructions*, were published at Seville on the 29th of October 1484.

The first of these regulated the manner in which the institution of the tribunal should be announced in those countries or places where it might be judged necessary to establish it. The second ordained the publication, in the church of the place, of an edict accompanied with the *censures* provided against those who, having committed the crime of heresy or apostasy, should not voluntarily denounce themselves before the expiration of the term of grace which had been granted them, and also against those who should obstruct or resist the execution of the measures ordained by the Holy Office. By the third, a delay of thirty days was allowed to heretics to declare themselves, and thereby to prevent the confiscation of their goods, without prejudice, however, to the pecuniary fines to which they might afterwards be condemned. By the fourth, it was provided that the voluntary confessions of those who declared themselves should be made in writing in the presence of the inquisitors and a registrar, so that the self-accused might be required to answer all the questions which might be addressed to them by the inquisitors on the subject of their confession, and also respecting their accomplices, and those whom they knew or suspected to be guilty of apostasy. The fifth prohibited giving secret absolution to any one who had made a voluntary confession, excepting in the single case where no one had had knowledge of his crime, and where there was nothing to apprehend from its publicity. By the sixth article it was provided that part of the penance enjoined on him who had been reconciled should consist in his being deprived of the exercise of every honourable employment, and of the use of gold, silver, pearls, silk, and fine linen. The seventh imposed pecuniary fines upon those who had made a voluntary confession. The eighth provided that the voluntary penitent who might present himself with his confession, after the expiration of the term of grace, should not be exempted from the penalty of confiscation of goods, which he would otherwise have incurred. In the ninth article, it was enacted, that if persons under the age of twenty presented themselves to make confession, after the expiration of the term of grace, and if it were proved that they had been led into error by their parents, it would be sufficient to impose on them a slight penance. The tenth imposed on inquisitors the obligation of declaring, in the act of reconciliation, the time in which the reconciled had fallen into heresy, in order to ascertain what portion of his goods belonged to the fisc. The eleventh article bore, that if a heretic detained in the secret prisons of the Holy Office, were touched with due repentance, and demanded absolution, it might be granted him, by imposing as a penance the pain of perpetual imprisonment. By the twelfth, it was provided, that if the inquisitors considered the confession of the penitent to have been simulated, in the case indicated in the preceding article, they should refuse absolution, declare him a false penitent, and condemn him as such to be *relaxed*, that is, delivered over to the secular arm. The thirteenth ordained that if a man, absolved after free confession, boasted of having concealed several crimes, or if it appeared, from information afterwards obtained, that he had committed more than he confessed, he should be arrested, and judged as a false penitent. The fourteenth provided, that if the accused, when convict-

[1] *Histoire Critique de l'Inquisition d'Espagne*, Paris, 1818, 4 vols. 8vo. Llorente had been an inquisitor himself (at Calatayud) and was probably on that account selected to prepare a digest of the materials for a history of the Inquisition, furnished by the archives of the Holy Office.

ed, persisted in denying the charge, even after the publication of the evidence, he should be condemned as impenitent. By the fifteenth, if there were only a *semi-plena probatio* against the accused, who denied the crime charged against him, he might be subjected to the question; in which case, if he confessed himself guilty under the torture, and thereafter confirmed his confession, he was punished as one regularly convicted; but if he retracted, he was to undergo, a second time, the same probation, or to be condemned to an extraordinary punishment. The sixteenth prohibited communicating to the accused an entire copy of the declarations of the witnesses. They were only to be informed generally what had been deposed, without being made aware of any circumstances which might enable them to discover who had given evidence against them. The seventeenth article enjoined inquisitors themselves to interrogate the witnesses, in every case where it was possible for them to do so. The eighteenth provided that two inquisitors should be present when the person arraigned was put to the question; but if otherwise occupied, they might appoint a commissary to receive the declarations of the sufferer. By the nineteenth article, if the accused did not appear, after having been cited according to the prescribed forms, he might be condemned as a convicted heretic. The twentieth bore, that if it were proved by the books, or by the conduct whilst in life of a person deceased, that he had been a heretic, he might be judged and condemned as such, his corpse disinterred, and the whole of his property confiscated to the state, at the expense of his natural heirs. By the twenty-first article, the inquisitors were ordered to extend their jurisdiction over the vassals of the great lords; and if the latter refused to recognise it, to apply to them censures and other penalties. The twenty-second provided that if the person condemned to be *relaxed* to the ordinary tribunal left children minors, a small portion of the confiscated property of their father should be granted them by the government, in name of alms, and the inquisitors should be obliged to confide to proper persons the care of their education and Christian instruction. By the twenty-third, if a heretic reconciled during the term of grace, without having incurred the penalty of confiscation, should have acquired property from a person who would have been condemned to that penalty, such property was not to be included in or protected by the law of pardon. The twenty-fourth rendered it obligatory to restore to liberty the Christian slaves of the reconciled, when confiscation had not taken place, provided the king had granted pardon only on that condition. The twenty-fifth article prohibited the inquisitors, and other persons attached to the tribunal, from receiving presents, under pain of incurring the greater excommunication, being deprived of all their employments, condemned to make restitution, and amerced in twice the value of the articles received. The twenty-sixth recommended to the officers of the Inquisition to live in peace with one another, without affectation of superiority even on the part of him who might be invested with the powers of the ordinary of the diocese; and, in case any difference should arise, it was reserved for the inquisitor-general to settle it quietly (*sans éclat*). By the twenty-seventh, inquisitors were expressly enjoined to watch carefully over their subordinates, in order that the latter might be exact in discharging their duties. Lastly, the twenty-eighth article committed to the prudence of the inquisitors the examination and discussion of all points which might not have been provided for in the foregoing constitutions.

Such is the substance of the Code of the Inquisition, as originally promulgated, perhaps the most extraordinary digest ever formed for consolidating a system of religious tyranny. From this abstract, indeed, it must be evident, whether we examine the twenty-eight articles in detail, or consider them as a whole, that the judgments and sentences pronounced would depend upon the manner in which the charge was prepared, and the particular views and feelings entertained by the judges, who were to decide as to the heresy or orthodoxy of the accused, according to inductions, analogies, or consequences, deduced from facts or isolated observations, reported with more or less of exaggeration and infidelity.[1] The code in question was, however, several times augmented, even in the early days of the Inquisition. In particular, there were added to it the instructions which had been prepared at Seville in the beginning of 1484, those of Valladolid in 1488, those of Toledo and Avila in 1498, and, lastly, those of Valladolid in 1561. But with all these modifications the forms of procedure underwent little or no change; nor was the arbitrary character which distinguished this cruel and odious jurisprudence in any degree mitigated. It was scarcely possible for the accused, however innocent, to establish an effectual defence. Placed between the alternative of either recognising his innocence, or suspecting him of guilt, the judges constantly allowed themselves to adopt the latter course, which at once superseded the necessity of proof, and left the accused entirely at their mercy.

The additional acts of the inquisitor-general Torquemada also fall under the description which has already been given. They were eleven in number, and principally intended to regulate details. They provided that in every subaltern tribunal there should be two inquisitor-jurisconsults, a fiscal, an alguazil, registrars, and other officers if required; that every functionary who received presents either from the accused, or their families, should be immediately dismissed; that the Inquisition should maintain at Rome an able jurisconsult, with the title of agent; that contracts signed before the year 1479 by persons whose goods happened to be seized after that period, should be valid; that proprietors who might have afforded to fugitives an asylum on their estates, should be held as having placed their whole property at the disposal of the government; that the notaries of the Inquisition should keep accounts of the effects of persons condemned; that the receivers of the Holy Office might sell that property, the administration of which they found troublesome, and collect the rents of such as was immoveable; that each receiver should attend to the interests of the tribunal to which he was more immediately attached; that the goods of a person condemned could not be sequestrated without an order of the Inquisition; that the inquisitor and other officers should be paid their salaries quarterly by the receiver; and that, in regard to circumstances unprovided for in the new constitutions, the inquisitors should have a discretionary power to act as they judged best, but that, in matters of great importance, they should have recourse to the government for instructions.

The crimes of which the Inquisition took cognisance were heresy in all its different forms, apostasy, Judaism, Mahommedanism, sorcery, offences against nature, and polygamy; and the punishments consequent on conviction varied according to the presumed degree of delinquency, from temporary confinement and severe penance to the *san benito*[2] and the *auto-da-fe*. This tribunal was not esta-

[1] "Que devait-on attendre de tels hommes, devenus les arbitres de la vie et de la mort de leurs semblables, en les voyant complettement aveuglés par leurs préventions contre des accusés sans défense? L'homme simple devait succomber; l'hypocrite seul triompha."—(Llorente, *Hist. Crit. de l'Inquisit. d'Espagne*, i. 184.)

[2] *San benito* is a corruption of *saco bendito*. Its true name in Spanish was *zamarra;* but *saco bendito*, corrupted into *san benito*, became the vulgar name, because, since the time of the Hebrews, a *sack* was the habit of penitence.

blished without great opposition. The first inquisitor of Aragon was openly assassinated, and all the provinces of that kingdom offered the most strenuous resistance to a jurisdiction which trenched so much on their ancient rights and privileges. But their opposition proved unavailing, as did also an attempt made by the Cortes of Castille and Aragon to reform the Holy Office after it had been established. The Inquisition triumphed over all its adversaries, and soon became so formidable, that parents delivered up their children, husbands their wives, and masters their servants, without a murmur. Terror, in fact, constituted the great element of its power; nor was this feeling diminished in force by the suddenness with which it pounced on its victims, and the impenetrable secrecy in which all its proceedings were involved. Its stroke was like that of fate. No man knew when it might descend on his own head; every one felt that resistance was vain, and escape impossible. Imagination lent its aid to exaggerate the fearful reality; terror froze all hearts; even kings and princes trembled before it. Nor can it be denied that, in its high and palmy days, its proceedings were marked by a bold and fearless impartiality. It scrupled not to arrest and proceed against Don Carlos of Austria, prince of the Asturias, whom death alone placed beyond the reach of its sentence. It instituted processes against Charles V., Philip II., the Duke of Alba, and other illustrious personages, the first of whom was accused of favouring Lutheranism, and the others were charged with want of zeal in the prosecution and extermination of heretics. Nor was it in any respect more lenient to the clergy than to the laity. Bartolomeo Carranza, archbishop of Toledo, a prelate of eminent learning, piety, and moderation, was accused of entertaining and countenancing certain opinions declared to be heretical, imprisoned for several years, and, after enduring the greatest sufferings, died before his process was brought to a close, though it ended in a sentence of absolution. With regard to the inferior clergy, a charge of heresy, or even the suspicion of having shewn kindness to heretics, was almost equivalent to a capital condemnation. Neither rank, nor age, nor sex, afforded any defence against its watchful vigilance and its pitiless severity. It was instituted to preserve the uniformity of the faith, and, in Spain at least, it completely succeeded.[1]

Nor can it be doubted that the procedure of the Inquisition was eminently calculated to accomplish the objects for which it had been originally instituted. This consisted of several parts; namely, the denunciation, the inquest, the censure by qualificators, secret imprisonment, the primary audiences, the charges, torture, the requisitory, the defence, the proofs, the publication of the proofs, the definitive censure by qualificators, and the sentence.

The procedure of the Holy Office commenced by denunciation, or something held equivalent thereto, such as a discovery incidentally resulting from a deposition made before the tribunal in another affair; and this, when signed, assumed the form of a declaration, in which the delator, after having sworn to tell the truth, designated by their names, or in some other manner, the persons whom he believed or presumed to be able to give evidence against the denounced. Then followed the inquest, or examination of the persons named and designed in the declaration as cognisant of the facts and circumstances therein set forth, and who were made to promise upon oath that they would never reveal the interrogatories which they were to be called upon to answer. Next came the censure by the qualificators. When the tribunal had examined the preliminary *instruction*, and discovered therein sufficient grounds for further procedure; and when the registers of the other tribunals of the province had been examined, to ascertain if there existed in these any charges against the denounced; the whole was submitted by the inquisitors to certain theologians, called *qualificators of the Holy Office*, who indicated or *qualified* in writing the propositions meriting theological censure, as heretical, savouring of heresy, or calculated to lead to heresy: And in case the denounced was only suspected of this crime, they decided whether the suspicion was *light*, *grave*, or *violent*. As soon as the qualification here described had been made, the procurator-fiscal demanded that the denounced should be transferred to the secret prisons of the Holy Office. The tribunal had three sorts of prisons; public, intermediary, and secret. The first were those in which the Holy Office caused to be confined persons who, without being guilty of any crime against the faith, were accused of some delict, the punishment of which belonged of right to the Inquisition. The second were destined for such servants or ministers of the Holy Office as had committed some crime or some fault in the exercise of their functions, without, however, incurring the suspicion of heresy. The third or secret prisons were those in which heretics, or persons suspected of being so, were confined, and where the prisoners could only communicate with the judges, in the cases provided and with the precautions enjoined by the constitutions.[2]

In the three days which followed the imprisonment of the suspected, they gave him three audiences of *monition* or advice, to engage him to speak the truth and the whole truth, without concealing any thing which he had himself done or said, or which he could impute to others contrary to the faith. He was also told, that if he conformed faithfully to what had been prescribed to him in this particular, mercy would be shewn him, but that, in the contrary case, he would be treated with all the rigour of law. After the formality of the three audiences of monition had been gone through, the procurator-fiscal prepared the indictment against the prisoner, in conformity with the heads of accusation indicated or *qualified* in the *instruction*; and although there existed only a *semi-plena probatio*, he charged the facts deposed to as if they had been fully proved, and what was worse, he did not limit the articles or counts of his indictment to the number of facts declared, and dispensed with applying to each head of accusation the proper character or notion which distinguished it. The next part of the procedure was the most horrible, namely, the application of the torture. Although the prisoner, in the three audiences of monition, might have confessed as much as, or even more, than the witnesses had deposed to, the fiscal terminated his requisitory or accusation, by demanding that the accused should be subjected to the question, on the alleged ground

[1] See Llorente, *Hist. Critiq. de l'Inq. d'Espagne*, tom. iv., and M'Crie's *History of the Reformation in Spain.*

[2] " Il serait difficile de rien concevoir de plus affreux que ces réduits," says Llorente; " non qu'ils soient à présent tels qu'on les a décrits, c'est-à-dire profonds, humides, sales et mal-sains: à ces traits il est plus facile de reconnaître les rapports inexacts et exagérés des victimes de l'Inquisition que le témoignage de la vérité. Je ne parlerai de ce qu'ils ont été autrefois, mais il est certain qu'aujourd'hui ces lieux sont de bonnes chambres voûtées, bien eclairées, sans humidité, et où il est permis de faire un peu d'exercice. Mais ce qui les rend un séjour vraiment redoutable c'est qu'on n'y entre sans être à l'instant flétri dans l'opinion publique; infamie à laquelle aucune autre, soit civile, soit ecclésiastique, n'expose les prisonniers; c'est qu'on y tombe dans une tristesse inexprimable, compagne inévitable d'une solitude profonde et continuelle; c'est qu'on n'y connait jamais l'état de la procédure dont on est l'objet, et qu'on ne peut y jouir de la consolation de voir et entretenir son défenseur; enfin, c'est parcequ' on y est plongé pendant l'hiver dans des ténèbres de quinze heures par jour, car il n'est point permis au prisonnier d'avoir de la lumière après quatre heures du soir ni avant sept heures du matin; intervalle assez long pour qu'une hypochondrie mortelle s'empare du prisonnier, au milieu du froid, dont il est saisi dans un séjour où le feu n'a jamais pénétré." (*Hist. Crit. de l'Inquisit. d'Espagne*, i. 300.)

of culpable concealment and denial of the truth. It is certain that for a long period the torture had not been applied by the inquisitors, either in Spain or in any other country, the mitigating and humanizing influence of time and improvement having virtually abolished this barbarity; but the form of procedure still remained unchanged. The *requisitory* or accusation of the fiscal was never communicated in writing to the accused, to enable him to prepare his defence. He was conducted into the hall of audience, where, in presence of the inquisitors and the fiscal, a secretary read over the charges one after another, stopping at each article, and calling upon the accused to answer at the instant, whether it was conformable to the truth or otherwise; thus laying a snare for the unhappy person who was about to be put on his trial. After the accusation had been read, the inquisitors asked the accused if he wished to be defended. If he answered in the affirmative, they ordered a copy to be taken of the accusation and answers, and, from the list of titularies of the Holy Office, appointed him an advocate. No prisoner was permitted to choose his own counsel, although there existed no law of the Holy Office which denied him this just and natural right. To the proof, and the publication of the proof, as it was called, both gross mockeries of justice, succeeded the definitive censure by the qualificators, or theologians of the Holy Office, to whom was remitted the original of the judgment they had pronounced on the summary instruction, together with an extract of the answers made by the accused in his last examination, and who were required to qualify for the second time the propositions upon which the accusation was founded, to consider the explanation given by the prisoner, and to decide whether he had, by his answers, elided in whole or in part the suspicion of heresy with which he was charged, or whether, on the contrary, he had not fortified the suspicion of his guilt. The importance of this censure must be evident, since on it depended the definitive sentence. Yet, says Llorente, "les *qualificateurs* se donnent à peine le temps d'écouter une lecture rapide de ce qui s'est passé; ils se hâtent d'établir leur opinion, et c'est là le dernier acte important de la procédure," all the rest being a simple formality. Lastly, came the sentence, which, as may easily be anticipated from the nature of the procedure, was generally condemnatory of the prisoner. In fact, before the reign of Philip III., sentences of absolution were so rare in the Holy Office, that in one or even two thousand judgments we scarcely find an instance where the prisoner was fully acquitted, because the slightest doubt as to the complete innocence of the accused led the qualificators to declare him suspected *de levi*, and this was sufficient to induce the inquisitors to condemn him to suffer pains more or less grave, according to circumstances, and to make a formal abjuration of all kinds of heresy, particularly of that of which he had incurred the suspicion.

> Devant l'Inquisition, quand on vient à jubé
> Si l'on ne sort rôti, l'on sort au moins flambé.

The reading of the judgment formed the finale of the procedure which we have been endeavouring to describe; and the execution of it always commenced in the same *auto-da-fe* where it was read and signified.

We shall not attempt to describe a public and general *auto-da-fe*, because all the circumstances attending that ceremony may be found detailed in several works, and even represented in engravings, which exhibit to the eye a picture of the horrors of which no pen can convey any adequate conception. We shall only speak here of the *san-benito*, to which reference has already been made in a previous part of this article.

This vestment was merely a kind of scapulary which was fitted close to the person, and descended only to the knees, in order that it might not be confounded with any form of the monastic habit. This last circumstance led the inquisitors to perfer for the *san-benito* an ordinary woollen stuff dyed yellow, with crosses of a red colour, by which means every trace of resemblance between the habit in which the penitents of the Inquisition were clothed, and that worn by any of the religious orders, was completely annihilated. Such was the *san-benito* in 1514, when Cardinal Ximenes de Cisneros caused the ordinary cross to be replaced by that of St Andrew. Afterwards, however, the inquisitors varied the forms of the *san-benito*, in order that one of these might be applicable to each class or description of penitents. But we shall only mention here those which were in common use.

When a person had been declared *slightly suspected* of heresy, and condemned to make abjuration, if he demanded to be relieved from the censures *ad cautelam*, he was made to assume a *san-benito*, which the Spaniards of the fifteenth century called *zamarra*, and which was merely the scapulary we have already mentioned, without a cross in saltier. But if the condemned abjured as one *violently suspected*, he bore one-half of this cross; and if he made abjuration as a *formal heretic*, he bore it entire. This, however, applied only to those who, after having been reconciled, had their lives spared. But there were other kinds of *san-benito* for those who were condemned to perish in the flames. He who, after having been once absolved from the crime of formal heresy, and reconciled to the church, relapsed into his former errors, was denominated *relapsed*, and incurred the pain of death. His fate was inevitable, however lively might be his repentance, and even notwithstanding a second reconciliation. The only advantage which this last act procured him, was that of not being burned alive. He was merely strangled, or put to death in some other manner less horrible than by fire, and then his corpse was delivered to the flames. Thus, as there were three kinds of *san-benito* for the three classes of condemned who were delivered to the secular arm, so also the inquisitors contrived an equal number for those who were doomed to suffer death.

The *first* was that of prisoners who had repented before being condemned. It was formed of a simple yellow scapulary, with an entire red cross in saltier, and a round pyramidal bonnet, called *coroza*, of the same stuff as the *san-benito*, and garnished with similar crosses, but without any representation of flames, because the repentance of the accused having been manifested in time, had saved them from the penalty of cremation. The *second* was destined for those who had been definitively condemned to be delivered to secular justice, in order to undergo the pains of fire and who had repented, after their condemnation, and before being conducted to the *auto-da-fe*. The *san-benito* and the *coroza* were made of the same stuff. On the lower part of the scapulary was represented a human bust on a brazier, whilst the rest of it was covered with the resemblance of flames pointing downwards, to indicate that the criminal was not to be burned alive, because he had not been adjudged to suffer that punishment, but only to be thrown into the flames after being strangled. The same representations were painted upon the *coroza*. The *third* was for those who were treated as guilty of final impenitence. It was made of the same stuff (serge) as the others. The lower part exhibited a human bust on a brasier, surrounded with flames; and the rest was covered with flames in their natural direction, to shew that he who wore it was doomed to actual burning. On the vestment were also delineated grotesque figures of devils, which were painted thereon, to indicate that these lying spirits had entered and taken up their abode in the soul of the guilty. The *coroza* was charged with similar figures. Such were the principal forms of the *san-benito*. The others were intended for those adjudged to suffer milder penalties, as confinement and penance, and generally had inscribed on them the name, country, species of heresy, punishment, and date of condemnation of the delinquent, accompanied with a cross in saltier or with flames, according to circumstances.

As the Inquisition was the creation of an intolerant age, when religious zeal was envenomed by bigotry, and exasperated by schisms and divisions, so it has fallen before the humanizing influence of modern civilization, and is now, even in Catholic countries, only a matter of history. In Spain and Portugal it has ceased to exist even in name; in Italy and other countries, where it has not been formally abolished, it is merely an obsolete institution, which henceforward no one will ever succeed in reviving. But the time was when it acted with fearful energy and efficacy, and when, like the Vehmgericht of the middle ages, it struck terror into all hearts. In Spain alone, according to Llorente, upwards of three hundred and forty thousand persons were judged and punished, one way or other, by this tribunal. The following is the general result of his statement in figures:—

Burned alive,	31,912
Burned in effigy,	17,659
Subjected to rigorous pains and penances,	291,450
Total,	341,021

And if to the number of victims immolated by the Inquisition in the Peninsula, be added all the unfortunates who were condemned by the tribunals in Mexico, Lima, Carthagena, Sicily, Sardinia, Oran, Malta, together with Naples, Milan, and Flanders, whilst these countries were under the dominion of Spain, it would probably be found that more than half a million of human beings had been condemned by this inexorable tribunal to undergo various punishments, a large proportion of which inferred infamy. (A.)

INSCRIBED, in *Geometry*. A figure is said to be inscribed in another, when all its angles touch the sides or planes of the other figure.

INSCRIPTION, in Latin *Inscriptio* (a word formed from the preposition *in* and *scribere* to write), and signifying something written or engraved on any substance, whether of wood, stone, metal, or other material, and having for its object to transmit to posterity the record of some important event or transaction.

It is well known that the ancients engraved on temples and columns the principles of science, as well as the events of history. In the early ages of the world this was the only means by which valuable truths could be preserved, and the memory of important transactions transmitted to succeeding ages. Sanchoniathon, a Phœnician historian, born at Berytus in Syria, and who flourished about the time of the Trojan war, is said to have drawn most of the materials of his history from inscriptions which he found in temples and on columns, both in his own country and in Palestine. But however this may have been, the circumstances mentioned by Herodotus shew, that the first method of instructing men, and of transmitting sciences as well as history to posterity, was by inscriptions. And this is confirmed by Plato, who, in his *Hippias*, informs us that Pisistratus caused to be engraved on stone, for the benefit of his countrymen, useful precepts in husbandry. Pliny assures us that the earliest public monuments consisted of plates of lead, on which were engraved the records of public transactions; and, in corroboration of this, he mentions, by way of exception, that the treaty of confederacy concluded between the Romans and the Jews, was inscribed on plates of brass, in order that the record of the compact might be less liable to be effaced, and that the Jewish people might always have something to remind them of the alliance which they had formed with the Romans. Nor were inscriptions discontinued in proportion as the art of writing was improved and facilitated. On the contrary, amongst the Greeks and Romans especially, this method of preserving the memory of important events, in connexion with distinguished names, continued to be employed long after it had ceased to be a matter of necessity; and hence the multitude of inscriptions, or fragments of inscriptions, which has outlasted the injuries of time, and the still more destructive dilapidations of barbarism.

Inscriptions are of different kinds, and they have been variously classed. Spohn, for instance, has divided archæography into no less than eight parts, viz. numismatography, epigrammatography, architectonography, iconography, glyptography, toreumatography, bibliography, and angiography. But this classification, which Boeckh has denominated rude, appears to be extremely unscientific and arbitrary, and not being founded upon any clear or definite principle, it is calculated to involve the subject in inextricable perplexity. A more natural and obvious division readily suggests itself. Inscriptions, generally considered, may be arranged in two classes, namely, *numismatic* and *monumental;* the former including the legends preserved on ancient coins and medals; the latter, the texts engraved on palaces, temples, and other edifices, together with those on columns, obelisks, statues, and such like monuments. The one of these branches is entirely distinct from, and can never be confounded with the other. In numismatics, our attention is exclusively confined to simple legends, consisting merely of names, titles, and dates. In monumental inscriptions we meet with texts, or the remains of texts, which, besides names and titular or official designations, contain, in a more or less perfect form, records of particular transactions or events, the memory of which it was intended thus to perpetuate. But the latter, with reference to their subjects, may nevertheless be subdivided into four different kinds. These are, first, the inscriptions relating to public affairs and civil institutions, which it is the principal object of the historian to investigate; secondly, those which respect private affairs, or the economy and intercourse of common life; thirdly, those which relate to the ceremonies of religion, and the arts or observances therewith connected; and, lastly, those which have reference to the history of science, whether as respects philosophy, mythology, or any other branch of knowledge. Under one or other of these heads may be included every kind of monumental inscription.

The most remarkable inscriptions in the world are those sculptured on the temples, palaces and obelisks, or painted on the interior of the *hypogæa* or burial-vaults of the ancient Egyptians; the texts, in cuneiform characters, observed on the ruins of Persepolis, as well as on vitrified bricks found amidst the ruins of Babylon; and those preserved on the pillars and ornamental parts of the rock-temples of Elephanta, Ellora, Carli, and other ancient monuments in India. Of the first of these, some account has already been given in the article HIEROGLYPHICS, to which the reader is accordingly referred. In this interesting field of inquiry, modern sagacity has, in part, triumphed over the difficulties, so numerous and formidable, which seemed destined to oppose an insuperable barrier to all investigation. But much, very much, yet remains to be done; indeed, the task may be said to have only been commenced. Proper names have been deciphered, legends have been interpreted and explained, dates have also been determined; but the body of those texts, to which the history of ancient Egypt has probably been consigned, still remains as great a mystery as ever. To a double or perhaps triple lock only one key has as yet been found. With regard to the Persepolitan characters, again, various attempts have been made to decipher them, though hitherto without any certain or assignable success. By a fortunate accident or rather conjecture, M. Saint-Martin has, we understand, been enabled to detect the name of *Xerxes* upon a vase in the cabinet of the King at Paris. But whilst little reliance can be placed on such divinations, it is plain that the interpretation, even if well-founded, cannot afford sufficient data for advancing a single step beyond it. No parasite translations into any known language have been discovered, as in Egypt, where the pillar of Rosetta and the monument of Philæ afforded the means of instituting tentative comparisons, and furnished the elements of an alphabet; nor is it at all probable that, without some such accessory helps, any progress will ever be made in determining the values of the nail-headed characters. The Indian inscriptions, also, still remain in a great measure undeciphered; nor has there yet been found any certain or safe clew calculated to lead to the interpretation of the characters in which they are written, much less of the texts which these characters have been employed to express. The discovery of such a key, indeed, is a question in the theory of probabilities, where the chance of failure is to that of success, within a given time, as a number incalculably great to unity. Some interpretations have, indeed, been published, as for example of the Allahabad and Delhi inscriptions, and also of those found in the caves of Carli; but none of the interpreters, so far as we know, has condescended to state the data on which he proceeded, or to explain the process by which he was enabled to construct an alphabet; and it must be evident that, without the most distinct and precise information on this point, no confidence can be placed in the results alleged to have been obtained.[1]

Inscriptions in an unknown character have also been found cut upon granite and sandstone rocks, between Mount Sinai and the Red Sea. Several specimens of these now lie before us, copied from the rocks at Wady Magara, Gebel Mokat'teb, Mount Horeb, Wady Maggup, and Nasby. With the exception of a mixed inscription, and also one in Greek, and another Cufic, they are all in the same character. In those found at Wady Magara and Gebel Mokat'teb, we discover rude delineations of the camel, the horse, the goat, and the antelope, with, in one instance, the figure of a man holding a club or staff in his hand. The characters bear a considerable analogy to the Cufic, though much more distinct; and, judging from the figures of loaded camels, with their heads all turned in the same direction, it seems not improbable, that the texts record the transits of different caravans. In one of these inscriptions, a number of characters are marked out in such a manner, by a line underneath, as to suggest the idea that they represent the name of some distinguished person, upon a principle analogous to that which was observed in the royal scrolls of the Egyptian writing; and this conjecture is somewhat countenanced by the circumstance that, amongst the characters thus defined, there is one which occurs thrice. But there exist no data upon which to found an attempt at interpretation; nor can any opinion be formed as to their relative antiquity.

In the countries of the west, where civilization is comparatively but of recent origin, few remains of extinct forms of writing have been discovered. This is easily accounted for, because, in Europe, the origin of letters is of much more recent date than in those countries where such interesting relics are found. The language of the Eugubian tables is, no doubt, an exception, inasmuch as all the learning and ingenuity of scholars have as yet been insufficient to analyze its structure, or to penetrate the meaning of the texts in which it has been partially preserved. But, by a singular anomaly, the characters on these tables have been resolved into an alphabet; and it may not unreasonably be hoped, that the power thus obtained of combining words, will ultimately lead to the discovery of their respective values. The Runic characters and the Runic language are now pretty well understood.

But the category of inscriptions to which the most direct interest and the greatest importance are naturally attached, whether with reference to the subjects of history, antiquities, or philology, is that which includes the monumental remains of Greece and Rome, particularly of the former.

Not to mention the writers who, between the age of Herodotus and that of Cosmas Indopleustes, or even later, make frequent mention of inscriptions, Philochorus of Athens, who flourished between the 118th and the 129th Olympiad, and was deeply skilled in Attic antiquities, appears to have been the first who applied himself to this subject; and, on the authority of Suidas we learn that he published Ἐπιγραμματα Ἀττικα, or Attic inscriptions of different kinds. He was succeeded by Polemo Græcanicus, the son of Euegetus, and the contemporary of Aristophanes of Byzantium, who, on account of his indefatigable study of inscriptions, was denominated Στηλοκοπας. His principal works on this subject were, first, περι των κατα πολεις ἐπιγραμματων; secondly, περι των ἐν Λακεδαιμονι ἀναθηματων; thirdly, four books περι της Αθηνησιν ἀκροπολεως; and, lastly, περι των ἀναθηματων ἐν τη ἀκροπολει. Mention is also made of a book περι των Θηβαϊκων ἐπιγραμματων, by Aristodemus, a writer on Theban affairs, whose works have utterly perished. To these succeeded Alcetas περι των ἐν Δελφοις ἀναθηματων, Menetor περι ἀναθηματων, Apellas Ponticus, and Neoptolemus Parianus περι ἐπιγραμματων, who were afterwards followed by the authors of the Anthologies. Of the collections of Philochorus, Polemo, and others, however, nothing remains excepting some expressions, such as σταθμια χαλκᾶ and κερας ἐκπωμα ἀργυροῦν, with a few others; but it appears that, anciently, there existed a repository or collection of confiscated goods, arranged according to a method copied from the inscriptions, and that this fact was known both to Athenæus and to Pollux. The book of Heliodorus, περι των ἐν Αθηνησι τριποδων, must also have embraced inscriptions, as we find that the ancients early employed the denomi-

[1] With regard to the Carli inscriptions, the Rev. Mr Stevenson of Poonah, having directed his attention to the subject, employed a year and a half in searching for a key amongst the natives; but as the latter were wholly unacquainted with the characters in which these inscriptions were written, his researches proved fruitless. He then made a collection of alphabets used on the western side of India, and attempted, by means of these, to decipher the inscriptions; but still with indifferent success. The publication of the Allahabad inscription, however, gave a new impulse and direction to his studies, and at length he was enabled, though we are not informed how, to read and translate the Carli inscriptions. It would certainly have been much more satisfactory, and, in appearance at least, far less empirical, had Mr Stevenson condescended to state the data on which his method of interpretation is founded.

But be this as it may, the results alleged to have been obtained from the Carli inscriptions deciphered are curious. These are, first, that the rock temple in question was excavated about sixteen centuries ago; secondly, that the empire of Shalivahana, in the Deccan, continued at least a hundred years after his time; thirdly, that Buddhism was the religion at that time favoured by the ruling party; fourthly, that the Shakas, so far from supplanting the language and literature of the Brahmins, adopted the Sanscrit as the vehicle for transmitting the memory of their own deeds to posterity; fifthly, that a simpler character than the Devanagari was probably used at the time when the Vedas and other ancient compositions were committed to writing; sixthly, that the Arabic numeral ciphers had been introduced into India at the period above mentioned; and, lastly, that great caution must be observed in admitting local traditions as of authority in regard to the condition of society or the state of knowledge and manners in such remote times.

These results, however, though probable enough, require confirmation. We have already observed that Mr Stevenson's scheme of an alphabet is not satisfactorily developed; and Mr Princep found that, when applied to the Allahabad inscription, it did not convert the text of that monument into intelligible Sanscrit. Besides, Mr Hodgson, resident in Nepaul, has expressed his conviction that the characters of this incription, so far from having preceded, are in fact derived from the Devanagari, or literal symbols of the learned Hindus. It appears, also, that the Allahabad and Delhi inscriptions are identical with one discovered at Mattia-lath, on the Nepaul frontier.

nation of tripod. Lastly, Craterus Macedo, whom Niebuhr considers to have been the brother of Antigonus Gonatas, son of Craterus and Phila, published Ψηφισματων συναγωγην, or books περι ψηφισματων, in which he sought to confirm public transactions by extracts of decrees and other documents, the greater part of which he, doubtless, derived from inscriptions, whilst as to the remainder, it was in all probability obtained from the Attic rolls or registers. From this collection of Craterus, indeed, and from others of a similar description, derived from the same sources, those who have preserved to us the Attic decrees copied the documents which we find embodied in their works; and to it also may be referred the greater part of the decrees inserted by the orators, particularly those cited by Demosthenes in his celebrated oration for the crown.

The first modern work on inscriptions was that of Cyriacus Anconitanus, who, in the early part of the fifteenth century, applied himself to collect those remains which had escaped the ravages of the barbarous ages, and who, whatever some critics may allege to the contrary, displayed equal diligence and fidelity in the execution of this laborious undertaking. He was succeeded, at intervals, by a long series of learned men, extending downwards even to our own time, who devoted their talents and industry to the collecting, interpreting, and illustrating of the monumental remains of antiquity. Amongst these a distinguished place must be assigned to Gruter, whose *Corpus Inscriptionum* (Heidelberg, 1601, in folio) is still a work of high importance. It is an immense collection of Greek and Latin inscriptions, which having been commenced by Smetius, was considerably augmented by Gruter, who subjoined to it the *Notæ Romanorum veterum Tulii Tironis et Annæi Senecæ*, a work which has since been much surpassed. Gruter was followed by Reinesius, who compiled another large volume of inscriptions; and Reinesius was succeeded by Fabretti, who also published at Rome, in 1609, a large volume, in which he corrected numerous errors that had escaped preceding antiquarians, and added a number of inscriptions which they had omitted. The next collection which appeared was that of Grævius, in three volumes folio; a work of extensive erudition, and, in all respects, more complete than any which had preceded it. In the course of the last century, Scipio Maffei, a man of various learning, and eminently skilled in this branch of archæology, undertook to make a more complete collection than had yet appeared of Greek and Roman inscriptions, the former of which he proposed to include in the first volume of his work; but after the expenditure of much labour and research, he found that the enterprise exceeded in magnitude his powers of execution, and at length, in his old age, abandoned it in despair. The project of Carcanius, who meditated an universal collection of inscriptions, proved equally abortive; as did also that of Raponus, a man who, by his knowledge of Greek, was not unequal to the task, though he published only one commentation on Greek inscriptions, written in indifferent Latin. The first volume of Boeckh's splendid work, entitled *Corpus Inscriptionum Græcarum*, in folio, was published at Berlin in 1828, and at once established the author's claim to rank in the very first class of scholars and critics. It is indeed a masterpiece of learning, research, critical sagacity, and philosophical acuteness; nor, in point of typographical elegance and accuracy, is it equalled, or perhaps even approached, by any work which has yet appeared on the subject. This volume is divided into six parts, which treat respectively, of, 1. *Tituli antiquissima Scripturæ forma insigniores*; 2. *Inscriptiones Atticæ*; 3. *Inscriptiones Megaricæ*; 4. *Inscriptiones Peloponnesiacæ*; 5. *Inscriptiones Bœoticæ*; and, 6. *Inscriptiones Phocicæ, Locreæ, Thessalicæ.* Of the second volume only a small portion has as yet been published. Boeckh has drawn his materials not only from the larger collections of Gruter, Reinesius, Spohn, Fabretti, Muratori, Donius, Donatus, and others, but also from diaries, catalogues and descriptions of museums, itineraries, in a word, from books of every kind; and he acknowledges having been aided in his inquiries at the commencement of his undertaking by Bekker, Buttmann, Niebuhr, and Schleiermacher, as well as by Gerhard, Klütze, Müller, Bischoff, Steinhart, and other young men who have since distinguished themselves by their erudition. For full information as to the nature and object of the work, the method of treating the subject, the art of interpreting and emending inscriptions, examples of the most difficult and obscure fragments, and how the genuine are to be distinguished from the spurious, the entire from the corrupted or interpolated, the reader is referred to the general preface, which is full of curious and original learning.

Those persons who desire to study the Roman inscriptions, may consult any of the large collections already referred to; and they will also do well to bestow a careful perusal on Funccius *de Origine, Pueritia, et Adolescentia Linguæ Latinæ* (Francfort, 1720, in small 4to), a work of great learning, ingenuity, and research, in which the progress of the Latin language from infancy to maturity is distinctly traced, and appropriately illustrated. This magnificent idiom, which was gradually formed and perfected by grafting on the rude original stock of an uncouth and barbarous dialect successive improvements, suggested by converse with a refined people, who had made considerable advances in civilization, whilst Rome remained in a state of comparative barbarism, and which derived nearly all its peculiar excellences of form, structure, and expression, from the transfusion, partly of the vocabulary, and partly of the spirit of the ancient Greek, presents altogether one of the most interesting subjects of inquiry in the annals of philology; and it is chiefly by the aid of inscriptions that such an investigation can be successfully prosecuted. The history of the language, in short, reflects, like a glass, that of the progress of social and intellectual improvement. With regard to ancient Roman numismatics, the best manual, perhaps, which has yet appeared on the subject, is the work of M. Hennin (Paris, 1830, in two vols. 8vo), containing the elements of the science, and the nomenclatures, with an indication of the degrees of rarity of the antique monies and medals, and tables of their actual values. The first volume treats of the origin of monies, an invention which followed the introduction of commerce by exchange; of the epochs distinguishable in the style of the art, the legend, the form of the characters, and the metal employed in the coins; of the titles and functions of the persons entrusted with the direction of the fabrication of coins; of the materials employed in ancient coins and medals, their names, values, weights, dimensions, inscriptions or legends, and dies, with the method of detecting spurious medals; and, lastly, of the history of numismatical science. The second volume is occupied with four nomenclatures, which comprehend the whole of numismatics. The first is that of peoples, cities, and kings, arranged in the geographical order adopted in the cabinets; the second is that of the Roman *as*; the third is that of the medals of Roman families; and the fourth is that of the Roman emperors, of the Cæsars and the Tyrants, classed in chronological order. Each nomenclature is accompanied with a table of the value of the medals, which, however, is not remarkable for its accuracy. The works of Jobert, Patin, and Mangeart, though they contain excellent things, are antiquated; the Introduction of Millin, the Summary of Champollion-Figeac in the Portable Encyclopædia, and the Essay on the science of Medals by Dumersan, in the Numismatics of Anacharsis, are merely abridgments, which can scarcely satisfy those who desire to make themselves thoroughly masters of the subject.

As to the study of inscriptions, little need be said to shew its indispensable importance to the historian and philosopher, as well as to the antiquary and philologist. The records thus preserved contain much information which is not to be found in ancient authors; and they afford the best tests by which the accuracy of historians may be tried, their fidelity proved or impeached, their errors corrected, and their defects supplied. They determine dates, establish facts, and throw light on the modes and habits of civil life, as well as the observances of religion; whilst in many of them the most important historical documents have been preserved. In fact, it is only necessary to consult the Roman History of Niebuhr, to be satisfied as to the importance of inscriptions, considered as materials of history, and how greatly they may contribute, when skilfully interpreted and rightly understood, to elucidate obscurities, dispel doubts, correct mistakes, and reduce to their true value the fabulous legends of romancing chroniclers and poetical historians. Again, it is in inscriptions that the various phases, changes, and transitions of language are reflected as in a glass; it is by means of them alone that we are enabled to trace the progressive steps by which it advanced from its primitive state, characterized by a rude simplicity, to the more refined, perfect, and complicated form which, by a course of gradual improvement, it afterwards attained. The text of the Duilian column, for example, is an invaluable monument to the historian of the Latin language, which it exhibits in a state of transition from the rugged and uncouth form of a barbarous and dissonant dialect, such as that of the *Carmen Saliare* and the Fescennine verses, to the finished regularity of structure, and philosophical precision and elegance of arrangement, which we discover in the great writers of after times. As to the learned antiquary, again, he lives, moves, and has his being amidst these interesting monuments of the past; and whilst pursuing his minute investigations, perchance contributes in no unimportant degree to throw a new light on facts of more pith and moment than any of those which more immediately engage his attention. In a word, we may say to the historian, the scholar, and the antiquary, in regard to inscriptions, *Nocturna versate manu, versate diurna.* (A.)

INSCRUTABLE, Unsearchable, in *Theology*, is usually understood of the secrets of Providence, and the judgments of God, into which human reason is unable to penetrate.

INSECTS, Insecta, in *Natural History*. See Entomology.

Noxious Insects; Means of destroying them, or preventing their increase. Of those substances which have been generally observed to be efficacious in driving away or in destroying insects, mercury, and its various preparations, may be reckoned the most generally effectual. Sulphur is also useful. Oils of all kinds have often been deservedly recommended; and tobacco is not less remarkable for its utility.

Mercury is known to kill or drive away lice from the human body; and it may probably be of equal efficacy in ridding other animals of insects. For instance, a small quantity of mercurial ointment rubbed upon the skins of sheep, on the sides, between the fore-legs and the body, may kill or drive away the insect peculiar to these animals. Sulphur is recommended to be added to the mercurial ointment. Thus not only the insect peculiar to them, but also the scab, may be cured.[1] Ailway[2] directed that, in the winter, the walls, frames, and other parts of his green and hot houses should be well washed with corrosive sublimate mercury, dissolved in water. These houses had been greatly infested with red spiders and ants. After having been washed with this solution, neither of these were to be seen next summer. This wash, if made weaker, may be used on old garden-walls, and the roots of fruit-trees infested with insects. It may destroy the tender leaves of plants, though not the roots. The same wash will effectually destroy that disagreeable insect the bug, and all other insects of a tender cuticle; and it will not in the least hurt the colour of bed-furniture or hangings. Care must be taken that the wash be applied into every crevice or folding of the furniture with a painter's brush. It will sometimes be necessary to repeat the wash, as the ova of bugs may remain concealed, notwithstanding the utmost care.

Some of the West India islands were much infested with large ants, which greatly injured the sugar-canes. The remedy was, to dissolve corrosive sublimate mercury in rum, in the proportion of two drams to a pint of spirits. This solution was poured upon dry powdered sugar; and when the sugar was dried, it was laid in the paths of the ants. They ate it, and were destroyed. Might not this practice be imitated, by laying sugar thus prepared on paper or pieces of thin boards near the roots of fruit-trees infested by insects, especially when the fruit is ripening? The papers or boards might be taken in during the night, or when it rained. The sugar should be coloured with indigo, or other substance, thereby to mark it as a substance to be avoided by curious idlers.

We are informed that a person in Philadelphia employed brimstone in the following manner. Having cleared all round the roots of trees infested with caterpillars or other insects, he strewed some flowers of brimstone round the roots, and covered it with a thin sprinkling of fine mould, that it might not be blown away by the wind, yet so that the sun might operate through the mould, and cause the brimstone to fumigate. In this manner he destroyed the caterpillars. One pound he found sufficient for two hundred trees. In that hot climate the sun may perhaps have that effect; but it scarcely will in this. To drive insects from small trees, he also employed sulphur in the following manner. He split the end of a pole, and put in the slit some matches, set them on fire, and held them under the parts of the trees chiefly affected. A pole thus armed, he found, would answer for three or four trees. Brimstone mixed with damp straw, and set on fire, in hop-ground infested with the fly, for instance, might be of use in driving away that insect.

The itch is supposed to originate from a very small insect which nestles under the skin, and proceeds no farther; and it is, therefore, attended with no dangerous consequences. Brimstone made into an ointment with hogs-lard is a sure remedy.

Sheep are liable to an eruption on the skin, known by the name of the *scab*. Brimstone, when added to the mercurial ointment recommended for that disorder,[3] might perhaps render the application more efficacious and less dangerous.

The natives of hot countries are taught by experience, that an unctuous covering of their bodies prevents the bites of musquitos and all gnats. The white inhabitants in such countries are not sufficiently careful in preventing the least stagnant water near their dwellings, in which the musquitos are bred; they are produced even in the waste water thrown out. Dr Franklin, by a careful attention to this circumstance, guarded his family in Philadelphia from such insects. One day seeing a number of musquitos in his library, he found on inquiry, that one of his servants had taken off the cover of a tub placed near his window for receiving rain-water. On such an occasion the remedy is

[1] *Transactions of the Society for the Encouragement of Arts*, London, vol. vii. viii. p. 90.
[2] *Ibid.* vol. v. vi. p. 59.
[3] *Ibid.* vol. vii. p. 90.

easy, namely, shutting up the room for the day, so that the musquitos cannot come at any water, in which time they die. Though this caution may seem trifling to us who live in a mild climate, it is far otherwise in hot countries.

Oil being known to be most efficacious in destroying insects, may not the use of it be extended to the destruction of worms in the bowels of horses, where they probably occasion the violent pain which these animals seem sometimes to suffer? If the horse were for some time kept fasting, and a large quantity of oil, say a pint, were given, supposing worms were the cause, the oil might in that case destroy them.

Flowers, leaves, and fruits, are known to be devoured by caterpillars. But these are destroyed by oils, which close the lateral pores by which they breathe. For this purpose it is advised that, on the approach of spring, a cloth dipped in train oil be laid on those parts of the tree in which there is any appearance of them.

We are informed in the Memoirs of the Society of Agriculture at Paris, that oil of turpentine, when applied to animals covered with insects, destroyed the insects without hurting the animal. The author tried it on several trees, mixed with fine earth so as to incorporate therewith, adding water, till the whole was brought to some degree of fluidity. In this mixture he dipped branches of fruit-trees on which there were insects, and thereby destroyed not only the eggs but also the insects, without hurting the leaves. This composition may be got off by washing, or the first heavy shower. From these experiments the author thinks, that oil of turpentine may with equal efficacy be employed for killing various kinds of lice on domestic animals.

We are informed that Mr Winter, amongst other experiments on turnip-seed, steeped the seed twenty-four hours in a sufficient quantity of train-oil. He then drained the oil from the seed, which he mixed with a quantity of fine sifted earth, and immediately sowed it in drills. When the plants began to appear on the surface, the ground was sown with soot. He found that seed steeped in linseed oil answered equally well.[1] The turnips least injured by the fly, were those which grew from seed steeped in this way; they grew so luxuriantly as to produce rough leaves several days prior to the most flourishing of any of his other experiments, and were the better enabled to withstand the attack of the fly. The leaves of these turnips were of a darker green, and appeared twice as thick in bulk and luxuriancy as the other turnips, and were considerably larger. The seed was drilled an inch and a half deep, and a foot distant in the rows. Train oil is apt to kill the leaves of plants which have been injured by insects, but linseed oil has not that effect, though equally destructive to the insects. The train oil seems to act as an oil, and by its disagreeable smell to prevent insects approaching it. In this respect it may be successfully used to prevent field mice or other vermin preying on acorns, chestnuts, or other seeds steeped in it before they are sown.

When thus giving directions for preventing the fly on turnips, an experiment may be mentioned, by the disclosure of which a person gained a considerable reward. His secret was, running a roller over the ground early in the morning, whilst the dew remained on the ground, on the first appearance of the fly. The dew entangled the flies so much, that they could not make their escape, and were therefore crushed to death. But as the roller may leave the surface of the earth too hard, it was recommended to fix some boughs of elder in a gate or hurdle, to be drawn over the field; and if the boughs had before been fumigated with the smoke of tobacco, or tincture of assafœtida, the success would be the surer. The most certain method of preventing the injury done by the fly is to raise the plants in a nursery, and at a proper age to transplant them, being carried to the ground in a wheel-barrow filled with manure softened with water so as to admit the plants. This method will secure their more speedy growth. In the nursery the attack of the fly may be prevented by sprinkling soot or quicklime on the ground. The utility of transplanting turnips is evident by the practice of transplanting the turnip-rooted cabbage. They who are discouraged from having recourse to this practice by the expense attending it, do not reflect that the hoeing is prevented, and the plants grow the better, being set in fresh earth.

Before proceeding to direct the use of the last means mentioned, viz. tobacco, for destroying insects in turnips, it may be proper to mention an experiment made by Mr Green, of the flower-garden at Kew. He contrived a pair of bellows similar to that employed in recovering people apparently drowned. It had a cavity in the nozzle, in which some tobacco was put, with a live coal over it. The bellows being then worked, the tobacco was set on fire, and the smoke directed to any particular spot. A lady was fond of having the mosk-rose in her dressing-room, but was prevented having it on account of the green insects which constantly adhere to that plant. To remedy this inconvenience, Mr Green had a box made large enough to contain a pot in which a plant of the mosk-rose grew. In one end of the box was a hole, to admit the nozzle of the bellows; the bellows was worked, and the smoke was received into the box. When the tobacco was consumed, the nozzle was withdrawn, and a cork being put into the hole, the box thus remained till morning, when the insects were all laid dead on the earth. Being swept off, the plant was in a state fit for a dressing-room. Many plants thus infested with insects may be too large, or otherwise so placed as not to be put into a box. In this case it occurred to the writer of these observations, that sprinkling the plants with an infusion of tobacco in water might in some degree answer the same purpose. On trial he found it answer, and he thus freed other plants from their insects. He also used it on trees of easy access with advantage. Train oil is so inimical to tender plants or leaves, that it destroys them if insects have in the least hurt them; whereas the infusion, instead of killing the leaves, promoted a fresh vegetation.

Fruit-trees often become the prey of insects. Those trained against a wall, or as espaliers, being easily come at, much of the mischief may be prevented by cutting off the leaves as soon as they are observed to be curled; for then fresh eggs are laid on them, probably by butterflies. If sprinkled with the infusion of tobacco, it will prevent their coming to life. After the fruit is formed, the infusion must not be used, lest the taste and smell should remain. The scissors are then the proper remedies, which ladies may employ as amusement, and may thereby present fruit to their friends of their own preserving. A lye of the ash of plants sprinkled on the leaves may have a good effect, as also on other pot-herbs, which are often the prey of caterpillars. As many insects, besides those bred on the leaves or in the walls, may destroy the fruit, the sugar with the corrosive sublimate, as already described, may be laid in the way of other insects, to all which it will prove a speedy death. Diligent inspection of their retreats is the most certain means of preventing the loss sustained by snails. Ants are prevented rising up the trees by laying round the roots powdered chalk, or any other substance which, by entangling their feet, prevents their crossing it. Care should be taken to destroy their nests everywhere near the garden.

Hops have now become an article of so great consequence, that it deserves our particular attention. Early in its growth when the vines begin to ascend the poles, a black fly preys

[1] *Transactions of the Society for the Encouragement of Arts*, vol. v. p. 45.

on its leaves, frequently in such numbers as, by destroying the leaves, to interrupt the vegetation, much of the food of plants being absorbed by the leaves. The infusion of tobacco destroys them, or at least drives them away so effectually, that a plant almost totally stripped of its leaves has put out fresh leaves after the use of the infusion. If care be not taken, the insects will again fall on the fresh leaves. As the flies lodge on the lower side of the leaves, they are protected from storms of rain, and therefore the infusion must be driven upwards by a forcing-pump. It is said that the expense of tobacco is too great, but perhaps lime-water, or even water by itself, driven strongly against the leaves, might drive them away. The labour attending such experiments in a large plantation discourages persons, who do not reflect, that, if such means are used early, the flies may more easily be got rid of. Free ventilation is undoubtedly beneficial to all plants; and hence perhaps the particular advantages of drilling corns in rows a little distant. If alleys somewhat larger than common were made in the plantations of hops, there might be sufficient spaces left, where the alleys cross one another, to admit of setting damp straw or other materials mixed with brimstone, soot, or the like, on fire. Smoke itself is said to prevent the fly; and if so, it still will act more powerfully when mixed with such materials. It has been observed in Sweden, that the hops grow naturally amongst heaps of stones or fragments of rocks. They therefore advise to cover the ground round their roots with stones, which will prevent the insects laying their eggs near the roots in the ground, where they lay them to be protected during the winter. The stones will also preserve moisture at the roots during the summer. A rope cannot be drawn across a plantation of hops, as it can across a field of corn, in case of mildew. Here water to wash off the clammy juice, which entices and feeds insects, seems to be the only remedy. The plantation being well ventilated, may at least prevent the frequency of it. The forcing-pump will most effectually wash off this exudation.

INSINUATION, denotes a cunning and covert way of creeping into any person's favour; or it means something conveyed by implication or innuendo.

Insinuation *of a Will*, amongst civilians, is the first production of it, or the leaving it with the registrar, in order to its probate.

INSOLVENT, a term applied to such persons as have not wherewithal to pay their just debts. See Bankruptcy.

INSPECTOR, a person to whom the care and conduct of any work is committed.

Inspectors, in the Roman law, were such persons as examined the quality and value of lands and effects, in order to the adjusting of taxes and impositions in proportion to every man's estate.

The Jews have also an officer in their synagogue, whom they call חזן, *hhazen*, or *inspector*. His business consists principally in inspecting or overlooking the prayers and lessons, in preparing and shewing them to the reader, and in standing by him to see he reads correctly; and, if the latter make mistakes, he is to correct him.

INSPIRATION, amongst divines and others, implies the conveying of certain extraordinary and supernatural notices or intimations into the soul; or it denotes any supernatural influence exercised by God upon the mind of a rational creature, by which he is formed to a degree of intellectual improvement, to which he could not or would not have attained, in his present circumstances, in a natural way. Thus the prophets are said to have spoken by divine inspiration.

Some authors reduce the inspiration of the sacred writers to that particular care of Providence, which prevented any thing they had said from failing or coming to nought; maintaining, that these writers were not really inspired either with knowledge or expression.

According to M. Simon, inspiration is no more than a direction of the Holy Spirit, which never permitted the sacred writers to be mistaken. It is a common opinion, that the inspiration of the Holy Spirit regards only the matter, not the style or words; and this seems to fall in with M. Simon's doctrine of direction.

Theological writers have enumerated several kinds of inspiration. These are, an inspiration of superintendence, in which God so influences and directs the mind of any person, as to keep him more secure from error in a various and complex discourse, than he would have been merely by the use of his natural faculties; plenary superintendent inspiration, which excludes any mixture of error at all from the performance so superintended; inspiration of elevation, where the faculties act in a regular, and, as it seems, in a common manner, yet are raised to an extraordinary degree, so that the composition shall, upon the whole, have more of the true sublime or pathetic, than natural genius could have given; and inspiration of suggestion, when the use of the faculties is superseded, and God does, as it were, speak directly to the mind, making such discoveries to it as it could not otherwise have obtained, and dictating the very words in which such discoveries are to be communicated, if they are designed as a message to others. It is generally allowed that the New Testament was written by a superintendent inspiration. Without this the discourses and doctrines of Christ could not have been faithfully recorded by the evangelists and apostles; nor could they have assumed the authority of speaking the words of Christ, or evinced this authority by the actual exercise of miraculous powers. Besides, the sacred writings bear many obvious internal marks of their divine original, in the excellence of their doctrines, the spirituality and elevation of their design, the majesty and simplicity of their style, the agreement of their various parts, and their efficacy on mankind; to which may be added, that there has been in the Christian Church, from its earliest ages, a constant tradition that the sacred books were written by the extraordinary assistance of the Spirit, which must at least amount to superintendent inspiration. But it has been controverted whether this inspiration extended to every minute circumstance in their writings, so as to be in the most absolute sense plenary. Jerome, Grotius, Erasmus, Episcopius, and many others, maintain that it was not; whilst others contend, that the emphatical manner in which our Lord speaks of the agency of the Spirit upon them, and in which they themselves speak of their own writings, fully justify our believing that their inspiration was plenary, unless there be convincing evidence brought on the other side to prove that it was not. If it be said we allow that there were some errors in the New Testament, as it came from the hands of the apostles, there may be great danger of subverting the main purpose and design of that book; since there will be endless room to debate the importance both of facts and doctrines.

Inspiration, in *Physic*, is understood of that action of the breast, by which the air is admitted into the lungs; in which sense, inspiration is a branch of respiration, and stands opposed to *Exspiration*.

INSPISSATING, in *Pharmacy*, an operation by which a liquor is brought to a thicker consistence, by evaporating the thinner parts.

INSPRUCK or INSBRUCK, a city, the capital of the province of Tyrol, in the Austrian dominions. It is situated on the river Inn, where the Sill falls into that stream. Though not a strong it is a large city, containing twenty-one churches, two hospitals, an orphan house, several monasteries, and within the walls 1925 families, consisting of 10,237 individuals; the suburbs also are extensive and populous. It contains a gymnasium, with a good library, and fifteen professors in the several branches of theology, jurisprudence, medicine, and philosophy. It has manufactures of muslins and cambrics, and also of cutlery and other metallic wares. The house of the provincial government is a fine antique building, as is likewise the town-hall. It is in Lat. 47° 16′ 8″, and Long. 11° 18′ 22″ E.

INSTALLATION, the act of giving visible possession of an order, rank, or office, by placing the person collated or appointed in the proper seat.

INSTALMENT, a settling or instating any person in a dignity. The word is derived from the Latin *in* and *stallum*, a term used for a seat in church, in the choir, or a seat or bench in a court of justice, though Vossius is of opinion that the word is of German origin.

Instalment is likewise used for the ceremony by which the Knights of the Garter are placed in their rank, in the chapel of St George at Windsor.

INSTANT, a part of duration in which we perceive no succession; or it is that which takes up the time only of one idea in our minds.

INSTAURATION, the re-establishment or restoration of a religion, a church, or the like, to its former state. The word is by some derived from the old Latin *instaurum*, which signified the stock of things necessary for the tilling and managing of grounds, as cattle, tools, harness, and the like. But the word *instaurum* is only of the middle age; whilst *instauratio* is of much greater antiquity, and by some derived from *instar*, like, as importing a thing's being brought to its former likeness or appearance.

INSTERBURG, a city of the circle of the same name in the Gumbinen division of the province of East Prussia. It stands near the junction of the river Angerap with the Inster, by which the navigable river Pregel is formed. It contains two churches, 465 houses, and 5870 inhabitants. There are some manufacturers of cloth, linen, and hosiery. It is the seat of the several courts of justice for the ancient districts, which were a part of Lithuania. Lat. 54° 37′ 16″; Long. 21° 34′ 1″ E.

INSTINCT, a certain power or disposition of mind, by which, independently of all instruction or experience, without deliberation, and without having any end in view, animals are unerringly directed to do spontaneously[1] whatever is necessary for the preservation of the individual, or the continuation of the kind. Such in the human species is the instinct of sucking exerted immediately after birth; and such in the inferior creation is the instinct by which insects invariably deposit their eggs in situations most favourable for hatching and affording nourishment to their future progeny. These operations are necessary for the preservation of the individual and the continuation of the kind; but neither the infant nor the insect knows that they are necessary; they both act without having any end in view, and act uniformly without instruction and without experience.

The actions of the inferior animals are generally directed by instinct; those of man by reason. This, at least, is the case with respect to men in a state of civilization. In the savage state, they are probably little less the slaves of instinct than the brutes themselves. Concerning *human* instincts, indeed, philosophers differ widely in opinion; some maintaining that man is endowed with a greater number of instincts than any species of brutes, whilst others deny that in human nature there is any power or propensity at all which can properly be called instinctive.

This diversity of opinion may easily be traced to its source. There are not many original thinkers in the world. The greater part even of those who are called philosophers implicitly adopt the opinions of certain masters, whose authority they deem sufficient to supply the place of argument; and having chosen their respective guides, each maintains with zeal what his master taught, or is supposed to have taught. When Locke so successfully attacked the doctrine of innate ideas and innate principles of speculative truth, he was thought by many to have overturned at the same time all innate principles whatever; to have divested the human mind of every passion, affection, and instinct; and to have left in it nothing but the powers of sensation, memory, and intellect. Such, we are persuaded, was not his intention; nor is there any thing in his immortal work which, when interpreted with candour, appears to have such a tendency.

In our opinion, great part of the Essay on Human Understanding has been very generally misunderstood. Much of its merit, however, was soon discovered; and mankind, finding philosophy disencumbered of the barbarous jargon of the schools, and built upon a few self-evident principles, implicitly embraced every opinion advanced, or which they supposed to be advanced, by the illustrious author; especially if that opinion was contrary to any part of the scholastic system which had so long been employed to perplex the understanding, and to veil absurdity. Hence arose many philosophers of eminence, both at home and abroad, who maintained, as they imagined, upon the principles of Locke, that in the human mind there are no instincts, but that every thing which had been usually called by that name is resolvable into association and habit. This doctrine was attacked by Lord Shaftesbury, who introduced into the theory of mind, as faculties derived from nature, a sense of beauty, a sense of honour, and a sense of ridicule; and these he considered as the tests of speculative truth and moral rectitude. His Lordship's principles were in part adopted by Mr Hutcheson of Glasgow, who published a system of moral philosophy, founded upon a sense or instinct, to which he gave the name of the *moral sense*; and the undoubted merit of his work procured him many followers.

Men generally run from one extreme to another. It being now discovered, or at least supposed, that the human mind is endowed with instinctive principles of action, a sect of philosophers soon afterwards arose, who maintained with much vehemence that it is likewise endowed with instinctive principles of belief; and who built a system of metaphysics, if such it may be called, upon a number of innate, distinct, and independent senses. The rise of this sect is well known. Berkeley and Hume had adopted Locke's doctrine respecting the origin of our ideas; and had thence deduced consequences supposed to be dangerous in themselves, but which, it was thought, could not be denied without refusing the principles from which they were inferred. The foundation of the instinctive system being thus laid, the system itself was rapidly carried to a height far beyond what seems to have been the intention of its excellent author; and reason was well nigh banished from the regions of philosophy. For such a proceeding it is not difficult to assign the cause. The instinctive scheme requires much less labour of investigation than the systems of Locke

[1] As nothing is of greater importance in the philosophy of mind than accurate definitions, it may not be improper to observe, that throughout the whole of this article the word *spontaneous* is to be taken in the sense in which it is used in the following extracts from Hales's *Origin of Mankind*: "Many analogical motions in animals, though I cannot call them *voluntary*, yet I see them *spontaneous*. I have reason to conclude, that these are *not* simply *mechanical*." "The sagacities and instincts of brutes, the *spontaneousness* of many of their motions, are not explicable, without supposing some active determinate power connected to and inherent in their spirits, of a higher extraction than the bare natural modification of matter." If this be attended to, our definition of instinct will be found perfectly consonant to that which has been given by the author of *Ancient Metaphysics*: "Instinct," he says, "is a determination given by Almighty Wisdom to the mind of the brute, to act in such or such a way, upon such or such an occasion, without intelligence, without knowledge of good or ill, and without knowing for what end or purpose he acts."

and the ancients; for upon the principles of it, when carried to its utmost extent, every phenomenon in human nature is thought to be sufficiently accounted for, by supposing it the effect of a particular instinct implanted in the mind for that very purpose. Hence, in some popular works of philosophy, we have a detail of so many distinct internal senses, that it requires no small strength of memory to retain their very names. Besides the *moral sense*, we have the sense of *beauty*, the sense of *deformity*, the sense of *honour*, the *hoarding* sense, and a thousand others which it is needless here to mention.

This new system, which converts the philosophy of mind into mere history, or rather into a collection of facts and anecdotes, though it has made a rapid progress, is not yet universally received. It has been opposed by many speculative men, and by none with greater skill than Dr Priestley, who maintains, with the earliest admirers of Locke, that we have from nature no innate sense of truth, nor any instinctive principle of action; that even the action of sucking, in new-born infants, is to be accounted for upon principles of mechanism; and that the desire of the sexes is merely association.

Whilst men, eminent for candour as well as for science, have thus been disputing the limits between instinct and reason in the human mind, and endeavouring to ascertain the actions which result from each, two writers of name, treating of that subject, have advanced opinions, which, if admitted as just, must render the dispute henceforth ridiculous, and put an end for ever to all moral inquiries. Mr Smellie, in a work which he calls the Philosophy of Natural History, affirms that, between *instinctive* and *rational motives*, no distinction exists, but that the reasoning faculty itself is the necessary result of instinct; and Dr Reid, in his Essays on the Active Powers of Man, by attributing to instinct the action of breathing, seems to confound that principle with mere mechanism.

That reason, instinct, and mechanism, are all essentially different from one another, has hitherto been universally allowed; and it appears not to be a task of much difficulty to point out in what respect each of them differs from the other two. Actions performed with a view to accomplish a certain end are called *rational* actions, and the end in view is the *motive* to their performance. *Instinctive* actions have a *cause*, viz. the internal impulse by which they are spontaneously performed; but they cannot be said to have a *motive*, because they are not done with any view to consequences. Actions *automatic* have likewise a cause; but that cause is not internal impulse, but mere mechanism, by which they are performed without any spontaneity of the agent. Thus, a man gives charity in order to relieve a person from want; he performs a grateful action as a duty incumbent on him; and he fights for his country in order to repel its enemies. Each of these actions is performed from a motive, and therefore they are all rational actions. An infant is impelled to suck the breast, but he knows not that it is necessary for his preservation; a couple of young savages go together, for the first time, without any view to offspring, or any determinate idea of enjoyment. These actions have no motive, and therefore are not rational; but as they are performed by a spontaneous exertion of the agents, they are not to be attributed to mere mechanism; they are therefore instinctive actions. A man breathes without any motive, without any spontaneous exertion of his own, and that as well when he is asleep as when he is awake. The action of breathing, therefore, is neither rational nor instinctive, but merely automatic or mechanical. All this seems to be very plain. To talk of the motives of actions performed by instinct, in an argument intended to prove that between reason and instinct there is no difference, is either to beg the question or to pervert language. If the author of the Philosophy of Natural History chooses to call the impulse which prompts the infant to suck by the name of *motive*, he only uses an English word improperly; if it be his intention to affirm that such a motive is not totally and essentially different from that which prompts a man to give charity or to fight for his country, he affirms what all mankind know to be false.[1]

Having thus ascertained what we mean by instinct, we shall now proceed to inquire, Whether or not there be any instinctive principles in man? But in order to proceed upon sure grounds, it will be proper to consider, in the first place, such actions of the inferior animals as are generally allowed to be instinctive: for an attempt has lately been made to prove, that even these actions are the offspring of reason influenced by motives; and that instinct, as we have defined it, is a mere imaginary principle, which has no existence either in man or brute.

It has been said that caterpillars, when shaken off a tree in every direction, instantly turn round towards the trunk and climb up, though they had never formerly been on the surface of the ground. This is a striking instance of instinct. On the tree, and not upon the ground, the caterpillar finds its food. If, therefore, it did not turn and climb up the trunk it would inevitably perish; but surely the caterpillar knows not that such an exertion is necessary to its preservation; and therefore it acts not from motives, but from blind impulse. The bee and the beaver are endowed with an instinct which has the appearance of foresight. They build magazines, and fill them with provisions; but the foresight is not theirs. Neither bees nor beavers know any thing of futurity. The solitary wasp digs holes in the sand, in each of which she deposits an egg. Though she certainly knows not that an animal is to proceed from that egg, and still less, if possible, that this animal must be nourished with other animals, she collects a few small green worms, which she rolls up in a circular form, and fixes in the hole in such a manner that they cannot move. When the wasp-worm is hatched, it is amply stored with the food which Nature has destined for its support. The green worms are devoured in succession; and the number deposited is exactly proportioned to the time necessary for the growth and transformation of the wasp-worm into a fly; when it issues from the hole, and is capable of procuring its own nourishment. This instinct of the parent-wasp is the more remarkable, that she feeds not upon flesh herself. Birds of the same species, unless when restrained by peculiar circumstances, uniformly build their nests of the same materials, and in the same form and situation, though they in-

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[1] The author of *Ancient Metaphysics*, whose learned work contains much good sense on this subject, thus distinguishes between reason and instinct: "With respect to the mere animal, it is evident, that he pursues nothing but what is conducive either to the preservation of the animal life, or to the continuation of the kind. On the other hand, the object which the intellectual mind pursues, is the *fair* and the *handsome*, and its happiness consists in the contemplation of these. And though it pursue also what is *useful* and *profitable* for the being and well-being of the animal life, yet it is for the sake, not of the animal life itself, but of the το καλον, or *beautiful*; which, therefore, is the ultimate object of its pursuit in all things.

"Another material difference in practice betwixt the animal and intellectual mind is, that every action of intellect proceeds from an opinion formed concerning what is good or ill, beautiful or the contrary, in the action. When we do so, we are said to act from *will*, which is always determined by some opinion formed of the kind I have mentioned: whereas, when we act from mere appetite or inclination, without deliberation or opinion formed, we act as the brute does always; for he has no *will*, but is prompted to action by natural impulse, or ὁρμη, as the Greeks call it.

"A third very material difference is, that intellect, in all its operations, proposes ends, and devises means to accomplish these ends; whereas the instinct of the brute proceeds without consideration either of ends or means."

habit very different climates; and the form and situation are always suited to their nature, and calculated to afford them shelter and protection. When danger, or any other circumstance peculiar to certain countries, renders a deviation from the common form and situation of nests necessary, that deviation is made in an equal degree, and in the very same manner, by all the birds of one species; and it is never found to extend beyond the limits of the country where alone it can serve any good purpose. When removed by necessity from their eggs, birds return to them with haste and anxiety, and shift them so as to heat them equally; and it is worthy of observation, that their haste to return is always in proportion to the cold of the climate. But do birds reason, and all of the same species reason equally well, upon the nature and extent of danger, and upon the means by which it can best be avoided? Have birds any notion of equality, or do they know that heat is necessary for incubation? No. In all these operations men recognise the intentions of nature; but they are hid from the animals themselves, and therefore cannot operate upon them as motives.

Of the instinct of animals we shall give one instance more in the elegant and perspicuous language of Dr Reid. "Every manufacturing art among men," says that able writer, "was invented by some man, improved by others, and brought to perfection by time and experience. Men learn to work in it by long practice, which produces a habit. The arts of men vary in every age and in every nation, and are found only in those men who have been taught them. The manufactures of animals differ from those of men in many striking particulars. No animal of the species can claim the invention; no animal ever introduced any new improvement, or any variation from the former practice; every one of the species has equal skill from the beginning, without teaching, without experience, and without habit; every one has its art by a kind of inspiration. I do not mean that it is inspired with the principles or rules of the art, but with the ability of working in it to perfection, without any knowledge of its principles, rules, or end. The work of every animal is indeed like the works of nature, perfect in its kind, and can bear the most critical examination of the mechanic or the mathematician; of which a honeycomb is a striking instance.

"Bees, it is well known, construct their combs with small cells on both sides, fit both for holding their store of honey and for rearing their young. There are only three possible figures of the cells, which can make them all equal and similar, without any useless interstices. These are the equilateral triangle, the square, and the regular hexagon. Of the three, the hexagon is the most proper, both for convenience and strength. Bees, as if they knew this, make their cells regular hexagons. As the combs have cells on both sides, the cells may either be exactly opposite, having partition against partition, or the bottom of the cell may rest upon the partitions between the cells on the other side, which will serve as a buttress to strengthen it. The last way is the best for strength; accordingly the bottom of each cell rests against the point where three partitions meet on the other side, which gives it all the strength possible. The bottom of a cell may either be one plane, perpendicular to the side partitions; or it may be composed of several planes, meeting in a solid angle in the middle point. It is only in one of these two ways that all the cells can be similar without losing room. And, for the same intention, the planes, of which the bottom is composed, if there be more than one, must be three in number, and neither more nor fewer. It has been demonstrated, that by making the bottoms of the cells to consist of three planes meeting in a point, there is a saving of material and labour no way inconsiderable. The bees, as if acquainted with these principles of solid geometry, follow them most accurately: the bottom of each cell being composed of three planes, which make obtuse angles with the side partitions, and with one another, and meet in a point in the middle of the bottom; the three angles of this bottom being supported by three partitions on the other side of the comb, and the point of it by the common intersection of these three partitions. One instance more of the mathematical skill displayed in the structure of a honeycomb deserves to be mentioned. It is a curious mathematical problem, at what precise angle the three planes which compose the bottom of a cell ought to meet, in order to make the greatest possible saving of material and labour. This is one of those problems belonging to the higher parts of mathematics, which are called problems of *maxima* and *minima*. The celebrated Maclaurin resolved it by a fluxionary calculation, which is to be found in the Transactions of the Royal Society of London, and determined precisely the angle required. Upon the most exact mensuration which the subject could admit, he afterwards found, that it is the very angle in which the three planes in the bottom of the cell of a honeycomb do actually meet.

"Shall we ask here, Who taught the bees the properties of solids, and to resolve the problems of *maxima* and *minima*? If a honeycomb were a work of art, every man of common sense would conclude, without hesitation, that he who invented the construction must have understood the principles on which it was constructed. We need not say that bees know none of these things. They work most geometrically without any knowledge of geometry; somewhat like a child, who by turning the handle of an organ makes good music without any knowledge of music. The art is not in the child, but in him who made the organ. In like manner, when a bee makes its comb so geometrically, the geometry is not in the bee, but in that great Geometrician who made the bee, and made all things in number, weight, and measure."

We have given a full detail of the structure of a honeycomb, because it is an effect of instinct which cannot be confounded with the operations of reason. The author of the Natural History of Animals, justly offended with that theory which treats of instinctive motives, which represents the human mind as a bundle of instincts, and of which the object seems to be to degrade mankind to the level of brutes, has very laudably exerted his endeavours to detect its weakness, and to expose it to contempt. But in avoiding one extreme, he seems to have run into the other; and whilst he maintains the rights of his own species, he almost raises the brutes to the rank of men. "It is better (he says) to share our rights with others than to be entirely deprived of them." This is certainly true; and no good man will hesitate to prefer his theory to that of his antagonist; but we see no necessity for adopting either; the phenomena may be accounted for without degrading reason to the level of instinct, or elevating instinct to the dignity of reason.

We shall readily allow to Locke,[1] that some of the inferior animals seem to have perceptions of particular truths,

[1] "For if they have any ideas at all, and are not mere machines, as some would have them, we cannot deny them to have some reason. It seems as evident to me, that some of them do, in certain instances, reason, as that they have sense; but it is only in particular ideas, just as they received them from the senses. They are the best of them tied up within those narrow bounds, and have not, as I think, the faculty to enlarge them by any kind of abstraction." (*Essay on Human Understanding*, book ii. chap. xi.)

This is in part a just observation, and serves to account for many phenomena which later writers have derived from instinct. The author of *The Philosophy of Natural History* had "a cat that frequented a closet, the door of which was fastened by a common iron latch. A window was situated near the door. When the door was shut, the cat gave herself no uneasiness. As soon as she tired of and within very narrow limits the faculty of reason; but we see no ground to suppose that their natural operations are performed with a view to consequences; and therefore cannot persuade ourselves with this historian of theirs, that these operations are the result of a train of reasoning in the mind of the animal.

He acknowledges, indeed, that their reasoning and thinking powers are remarkably deficient when compared with those of men; that they cannot take so full a review of the past, nor look forward with so penetrating an eye to the future; that they do not accumulate observation upon observation, nor add the experience of one generation to that of another; that their manners do not vary, nor their customs fluctuate like ours; and that their arts always remain the same, without degeneracy and without improvement. "The crow," he observes, "always builds its nest in the same way; every hen treats her young with the same measure of affection; even the dog, the horse, and the sagacious elephant, seem to act rather mechanically than with design. From such hasty observations as these, it has been inferred," he says, "that the brutes are directed in their actions by some mysterious influence, which impels them to employ their powers unintentionally in performing actions beneficial to themselves, and suitable to their nature and circumstances."

And are these observations indeed hasty? and is this inference ill founded? To us the matter appears quite otherwise. If the arts of brutes and other animals have always remained the same without degeneracy, and without improvement; and if they be at the same time the result of reasoning, they must either be so perfect that they cannot be improved, or so imperfect that they cannot degenerate. That the structure of a honeycomb is imperfect no man has ever imagined. We have seen, that as far as we are capable of discerning the end which it is intended to serve, it is the most perfect structure possible; and, therefore, if it be the result of the reasoning of the bee, the author must retract his assertion respecting the extent of the reasoning and thinking powers of inferior animals; and instead of saying that they are remarkably deficient when compared with those of men, affirm that they are infinitely more perfect. No human art has yet arrived at such perfection as that it might not be improved; no architect has ever built a town, or constructed a magazine, which he could mathematically demonstrate to be of the very best possible form for the end intended, and so absolutely perfect as to be incapable of improvement.

But the same author proceeds to affirm, that "the laws of analogical reasoning do not justify the idea that the brutes act, on any occasion, absolutely without design." Nay, he says, it seems more probable "that the inferior animals, even in those instances in which we cannot distinguish the motives which actuate them, or the views with which they proceed, yet act with design, and extend their views, if not a great way, yet at least a certain length forward; than that they can be upon any occasion, such as in rearing of their young, building nests, &c., actuated merely by feeling, or overruled by some mysterious influence, under which they are nothing but insensible instruments." This last phrase is ambiguous. If by insensible instruments it be meant that the brutes are considered by the advocates for instinct as mere machines without the faculties of sensation and spontaneity, the author is combating a phantom of his own creation; for we believe an opinion so absurd is not now maintained by any man (see Brute). But if by insensible instruments be meant such instruments as act spontaneously without being conscious of the end to which their actions lead, he appears not only to be egregiously mistaken in his conjecture respecting the design of brutes, but also to have advanced an hypothesis contradictory and inconsistent.

If it be true that the inferior animals act with design, even in those instances in which we cannot distinguish their motives, their views may indeed extend but a little way when compared with infinity: but certainly they extend farther than ours; for there is no useful work of man constructed with such skill, but that, after it is finished, another man of equal education will be able to distinguish the general design of the artist. But if the inferior animals, on all occasions, act with design, we should be glad to know the design of the bees in forming the cells of their combs in the manner which we have so largely described. Do these little animals indeed know that a comb, consisting on both sides of hexagonal cells, with the bottom of each composed of several planes meeting in a certain solid angle, and so formed as that the bottom of a cell on the one side shall rest upon the partitions between the cells on the other side, is in all respects the most proper both for holding their stores of honey and for rearing their young? And do they likewise know, that its excellence arises from the precise figure and position of the cells, by which there is a very considerable saving of labour and materials, whilst the comb at the same time has the greatest possible strength, and the greatest possible capaciousness? If they know all this, and act with a view to these ends, it must indeed be confessed that bees are rational creatures, and that their thinking and reasoning powers far surpass those of men; for they have from the earliest ages made discoveries in the higher mathematics, which there is reason to believe were altogether unknown to the human race till the begin-

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her confinement, she mounted on the sole of the window, and with her paw dexterously lifted the latch and came out." This practice, which we are told continued for years, must have been the consequence of what Locke calls reasoning in particular ideas. It could not be the effect of instinct; for instinct is adapted only to a state of nature, in which cats have neither latches to lift nor doors to open; and as it is not said that the animal attempted to lift the latches of other doors, we are not authorized to infer that this particular action was the consequence of reasoning in ideas enlarged by abstraction: the cat had repeatedly seen one door opened by an exertion which she was capable of imitating. Yet that animals have no power of enlarging their ideas, is a position, of the truth of which, though it is advanced by Locke, we are by no means confident. It is well known that crows feed upon several kinds of shell-fish when within their reach; and that they contrive to break the shell by raising the fish to a great height, and letting it drop upon a stone or a rock. This may perhaps be considered as pure instinct directing the animal to the proper means of acquiring its food. But what is to be thought of the following fact, which was communicated to us by a gentleman whose veracity is unquestioned, and who, being totally unacquainted with the theories of philosophers, has of course no favourite hypothesis to support? In the spring of the year 1791, a pair of crows made their nest in a tree, of which there were several planted round his garden; and in his morning walks he had often been amused by witnessing furious combats between them and a cat. One morning the battle raged more fiercely than usual, till at last the cat gave way, and took shelter under a hedge, as if to wait a more favourable opportunity of retreating to the house. The crows continued for a short time to make a threatening noise; but perceiving that on the ground they could do nothing more than threaten, one of them lifted a stone from the middle of the garden, and perched with it on a tree planted in the hedge, where she sat watching the motions of the enemy of her young. As the cat crept along under the hedge, the crow accompanied her by flying from branch to branch and from tree to tree; and when at last puss ventured to quit her hiding-place, the crow, leaving the tree, and hovering over her in the air, let the stone drop from on high on her back. That the crow on this occasion reasoned, is self-evident; and it seems to be little less evident, that the ideas employed in her reasoning were enlarged beyond those which she had received from her senses. By her se ses, she may have perceived, that the shell of a fish is broken by a fall; but could her senses inform her, that a cat would be wounded or driven off the field by the fall of a stone? No. From the effect of the one fall preserved in her memory, she must have inferred the other by her power of reasoning.

Instinct.

ning of the present century, and which at this moment are beyond the comprehension of nine-tenths of mankind in the most enlightened nation on earth. If this be a conclusion too absurd to be admitted, there is no other alternative but either to suppose that by this artificial structure of their cells the bees have some other end in view, which we cannot distinguish; or to acknowledge that they are overruled by some mysterious influence, under which they are nothing but spontaneous agents, unconscious of the end to which their operations tend. Which of these conclusions is the most rational, we will not offer such an insult to the understanding of our readers, as to suppose the meanest of them capable of entertaining a doubt. That a honeycomb is constructed with design, we must readily admit; but the design is not in the bees, but in the Creator of the bees, who directs their operations to their own good, by what the author with great propriety terms a mysterious influence.[1]

But he thinks it an unanswerable argument in support of his theory, that in the performance of those actions, in which animals are said to be guided by unerring instinct, different individuals display different modes of conduct; and in his opinion, to talk of instinctive principles which admit of improvement, and accommodate themselves to circumstances, is merely to introduce new terms into the language of philosophy; for he affirms, that no such improvement or accommodation to circumstances can ever take place without a comparison of ideas and a deduction of inferences. It is probable that the author here alludes to those animals which, in their most important operations, are known to act differently in different countries. Thus the ostrich in Senegal, where the heat is excessive, neglects her eggs during the day, but sits upon them in the night. At the Cape of Good Hope, however, where the degree of heat is less, the ostrich, like other birds, sits upon her eggs both day and night. In countries infested with monkeys, many birds, which in other climates build in bushes and clefts of trees, suspend their nests upon slender twigs, and thus elude the rapacity of their enemies.

It may be thought, that a determination of the mind of the brute to act so variously upon different occasions, can hardly be conceived without judgment or intelligence. But before our author had so confidently affirmed that such accommodation to circumstances can never take place without a comparison of ideas and a deduction of inferences, he would have done well to consider how nature acts in other organized bodies, such as the vegetable. We see that a vegetable, reared in the corner of a dark cellar, will bend itself towards the light which comes in at the window; and if it be made to grow in a flower-pot, with its head downwards, it will turn itself into the natural position of a plant. Can it be supposed, that the plant, in either case, does what it does from any judgment or opinion that it is best, and not from a necessary determination of its nature? But, further, to take the case of bodies unorganized, how shall we account for the phenomena which chemistry exhibits to us? When one body unites with another, and then, upon a third being presented to it, quits the first, and unites itself with it, shall we suppose that this preference proceeds from any predilection or opinion that it is better to cleave to the one than to the other, from any comparison of ideas or deduction of inferences? Or shall we not rather say, that it proceeds from an original law of nature impressed upon it by that Being who mediately or immediately directs every motion of every the minutest atom in the universe? And if so, why may not instinct be an original determination of the mind of the animal, of which it is part of the nature or essence to accommodate itself to certain circumstance, on which depends the preservation of the individual, or the continuation of the kind? Indeed it cannot be otherwise, if we have defined instinct properly; for no man ever supposed, that when animals work instinctively, they act for no purpose. It is only affirmed that the purpose is not known to them. It is known, however, to the Author of instinct; who knows likewise that the same purpose must in different climates be promoted by different means, and who accordingly determines the operations of animals of the same species to be different under different circumstances.

But though we cannot agree with this author when he affirms that no accommodation to circumstances can ever take place without a comparison of ideas, we readily admit that no faculty which is capable of improvement by observation and experience can in propriety of speech be termed instinct. Instinct being a positive determination given to the minds of animals by the Author of nature for certain purposes, must necessarily be perfect when viewed in connection with those purposes; and therefore to talk, as Mr Smellie does, of the *improvement* of instinct, is to perplex the understanding by a perversion of language. There is not, however, a doubt, but that reason may copy the works of instinct, and so far alter or improve them as to render them subservient to other purposes than those for which they were originally and instinctively performed. It was thus in all probability that man at first learned many of the most useful arts of life.

> Thy arts of building from the bee receive;
> Learn of the mole to plough, the worm to weave;
> Learn of the little nautilus to sail,
> Spread the thin oar, and catch the driving gale.

But the arts thus adopted by men are no longer the works of instinct, but the operations of reason influenced by motives. This is so obviously and undeniably true, that it has compelled the author last mentioned to confess, in that very section which treats of instincts improvable by experience, that "what men or brutes learn by experience, though this experience be founded on instinct, cannot with propriety be called instinctive knowledge, but knowledge derived from experience and observation. Instinct (he says) should be limited to such actions as every individual of a species exerts without the aid either of experience or imitation." This is a very just distinction between instinct and experience; but how to reconcile it with the fundamental principle of the author's theory we know not. It would certainly be a very arduous task; but it is a task from which we are happily relieved, as his theory and our's have little resemblance.

Having thus proved, we hope to the satisfaction of our readers, that there is such a principle as instinct in the inferior animals, and that it is essentially different from human reason, let us return to our own species, and inquire whether there be any occasions upon which man acts instinctively, and what these occasions are. This is a question of some difficulty, to which a complete and satisfactory answer will perhaps never be given, and to which we have not the vanity to think that such an answer will be given by us. The principle of association operates so powerfully in man, and at so early a period of life, that in many cases it seems to be impossible to distinguish the effects of habit from the operations of nature. Yet there are a few cases, immediately connected with the preservation of the individual and the propagation of the kind, in which by a little attention these things may be distinguished. We

[1] Though this way of acting is undoubtedly mysterious, "yet it should not appear extraordinary even to a man who is not a philosopher. as we see examples of it daily in our own species; for a man under the direction of another of superior understanding, will use means to accomplish an end, without having an idea of either; and indeed, in my opinion, by far the greater part of mankind are destined by God and nature to be governed in that way." (*Ancient Metaphysics*, vol. iii. p. 352.)

have already given an instance in the sucking of a child, which we believe to be an operation performed by instinct. Dr Priestley, however, thinks differently. "The action of sucking," says he, "I am confident, from my own observation, is not natural, but acquired." What observations they were which led him to this conclusion he has not told us, and we cannot imagine; but every observation which we ourselves have made, compels us to believe that an attempt to suck is natural to children. It has been observed by the author of the Philosophy of Natural History, that the instinct of sucking is not excited by any smell peculiar to the mother, to milk, or to any other substance; for that infants suck indiscriminately every thing brought into contact with their mouths. He therefore infers, that the *desire* of sucking is innate, and coeval with the appetite for air. The observation is certainly just; but a disciple of Dr Priestley's may object to the inference; for "in sucking and swallowing our food, and in many such instances, it is exceedingly probable," says the doctor, "that the actions of the muscles are originally automatic, having been so placed by our Maker, that at first they are stimulated and contract mechanically whenever their action is requisite." This is certainly the case with respect to the motion of the muscles in the action of breathing; and if that action be of the same kind and proceed from the very same cause with the action of sucking, and if a child never shew a desire to suck but when something is brought into contact with its mouth, Dr Priestley's account of this operation appears to us much more satisfactory than that of the authors who attribute it to instinct.

But the actions of breathing and sucking seem to differ essentially in several particulars. They are indeed both performed by means of air; but in the former, a child for many months exerts no spontaneous effort, whilst a spontaneous effort seems to be absolutely necessary for the performance of the latter. Of this indeed we could not be certain, were it true that infants never exhibit symptoms of a wish to suck but when something is exactly in contact with their mouths; for the mere act of sucking then might well be supposed to be automatic and the effect of irritation. But this is not the case. A healthy and vigorous infant, within ten minutes of its birth, gives the plainest and most unequivocal evidence of a desire to suck, before any thing be brought into actual contact with its mouth. It stretches out its neck, and turns its head from side to side apparently in quest of something: and that the object of its pursuit is something which it may suck, every man may satisfy himself by a very convincing experiment. When an infant is thus stretching out its neck and moving its head, if any thing be made to touch any part of its face, the little creature will instantly turn to the object, and endeavour by quick alternate motions from side to side to seize it with its mouth, in the very same manner in which it always seizes the breast of its nurse, till taught by experience to distinguish objects by the sense of sight, when these alternate motions, being no longer useful, are no longer employed. If this be not an instance of pure instinct, we know not what it is. It cannot be the result of association or mechanism; for when the stretching of the neck takes place, nothing is in contact with the child's mouth, and no association which includes the act of sucking can have been formed. Associations of ideas are the consequences of simultaneous impressions frequently repeated; but when the child first declares, as plainly as it could do were it possessed of language, its wish to suck, it has not received a single impression with which that wish can possibly be associated.

Were Dr Priestley to weigh these facts, of the truth of which we are certain, we doubt not that his well-known candour would make him retract the assertion, that all the actions which Dr Reid and others refer to instinct, are either automatic or acquired. The greater part of those actions, as well as of the apparently instinctive principles of belief, we have no doubt are acquired; but we are persuaded that a child sucks its nurse as a bee builds its cell, by instinct; for upon no other hypothesis can we account for the spontaneous efforts exerted in both these operations; and we think it no disgrace to our species, that in some few cases we should act from the same principle with the inferior creation, as nothing seems more true than that,

—— Reason raise o'er instinct as we can;
In this 'tis God that works, in that 'tis man.

We have said that, in the savage state, the sexes go together for the first time by instinct, without any view to offspring, and perhaps with no determinate idea of enjoyment. This opinion, we believe, has been generally maintained; but it is controverted by Dr Hartley. "Here," says he, "we are to observe, first, that when a general pleasurable state is introduced, either by direct impressions or by associated influences, the organs of generation must sympathize with this general state, for the same reasons as the other parts do. They must therefore be affected with vibrations in their nerves, which rise above indifference, into the limits of pleasure, from youth, health, grateful aliment, the pleasures of imagination, ambition, and sympathy, or any other cause which diffuses grateful vibrations over the whole system. Secondly, as these organs are endued with a greater degree of sensibility than the other parts, from their make, and the peculiar structure and disposition of the nerves, whatever these be, we may expect that they should be more affected by those general pleasurable states of the nervous system than the other parts. Thirdly, the distension of the cells of the *vesiculæ seminales* and of the sinuses of the *uterus*, which take place about the time of puberty, must make these organs more particularly irritable then." His fourth observation respects a state widely different from that of nature, and therefore is nothing to the purpose: but his fifth is, that "the particular shame which regards the organs of generation, may, when considered as an associated circumstance, like other pains, be so far diminished as to fall within the limits of pleasure, and add considerably to the sum-total."

To this excellent and able writer we may allow the truth of these observations, though some of them might certainly be controverted; and yet deny his conclusion, that "they are sufficient to account for the general desires which are observable in young persons, and that those desires are of a factitious nature." For supposing every thing which he mentions to take place by mere mechanism and association; that the organs of generation are irritated, and certain cells and sinuses distended; the only inference which can be fairly drawn from such premises is, that at the age of puberty young men and women must, from these causes, experience certain feelings and wants which they knew not before; but surely mechanism and association cannot teach them the use of the organs of generation, or point out the only means by which their new feelings can be gratified; and therefore, as we see these means invariably pursued by all animals, rational and irrational, without experience and without instruction, we must refer the mutual desire of the sexes to a higher principle than mere mechanism and association; and that principle can be nothing but instinct.

Besides these, we think the action of eating may be attributed to instinct. It is certainly performed by a spontaneous exertion of the proper organs; and that exertion is first made at a time of life when we have no conception of the end which it serves to accomplish, and therefore cannot be influenced by motives. It must, indeed, be confessed, that the first act of chewing is performed by a child, not for the purpose of masticating food, but to quicken the operation of nature in the cutting of teeth; and perhaps it may be said, that the pleasing sensation of taste, which is then first experienced, and afterwards remembered, prompts the child to continue at intervals the exertion of chewing after all his teeth are cut; so that though the act of eating is not performed with a view to the mastication of food or the nourishment of the body, it may yet be performed, not from any instinctive impulse, but merely from an early and decp-rooted association. But in answer to this it is sufficient to ask, Who taught the infant that the act of chewing will quicken the operation of nature in the cutting of teeth? Not reason, surely, nor experience; for an infant knows nothing of teeth, or the manner in which they grow; and if it be granted, that for this purpose it was originally impelled by some internal and mysterious influence to perform the action of chewing, we are not inclined to deny that the operation may be continued for other purposes, by means of association.

> In human works, though laboured on with pain,
> A thousand movements scarce one purpose gain;
> In God's, one single can its end produce,
> Yet serves to second too some other use.

This is sound philosophy, confirmed by observation and daily experience; but though in the works of God one principle produces many consequences, and though perhaps there is not a principle which falls under our cognizance more fruitful than that of association, yet if it be not sufficient to account for the first act of chewing, we cannot refer to it alone as to the source of that operation. Should it be said, that the gums of an infant are at the period of cutting teeth so irritable, that the moment any thing is applied to them the jaws perform a motion merely automatic, which we mistake for the spontaneous effect of instinct, still we would ask, What prompts the child to apply every thing to its mouth? Does the irritation of the gums contract the muscles of the arm? By a bigot for mechanism this might be said, were it true that the arm of an infant, like a piece of clock-work, is always so regularly moved as to bring its hand directly into contact with its gums: but this is far from being the case; an infant makes many unsuccessful efforts to reach its mouth, and does not accomplish its purpose till after repeated trials. Perhaps it may be alleged (for when men adopt a favourite hypothesis, they will allege any thing in its support), that infants are taught to carry things to their mouths by the pleasing sensation received from the application of their nurses' breasts, and continue the practice from habit and association. But it is certain that they do not begin this practice till teeth are forming in their gums; and then they use such things as they themselves carry to their mouths very differently from the breasts of their nurse: they constantly chew and bite their rattles, though they very seldom bite their nurses. As this practice cannot be begun from a principle of association, so it appears to us that it cannot be continued upon such a principle. Were the sensation experienced by an infant when chewing a hard substance a pleasing sensation, the remembrance of the pleasure might as a motive prompt it to repeat the operation; but it is obvious, that by pressing a gum, through which a tooth is making its way, against any thing hard, the infant must experience a painful sensation; and therefore the influence which impels it to continue this operation, must be something more powerful than pleasure or pain.

These three actions, then, by which infants suck, by which they chew their food, and by which mankind are propagated, have undeniably their origin in instinct. There may be many other human actions which derive their origin from the same source; but in a state of civil society it is very difficult, if not impossible, to distinguish them from the effects of early habit.

Such, however, is the present impatience of that labour, without which effects cannot be traced to their causes, that every phenomenon in human nature, which to former philosophers would have occasioned difficulty, is now thought to be sufficiently accounted for by referring it to some instinct as its particular cause; and he who can provide himself with a sufficient number of these instincts, for the reality of which he offers no proof, seats himself in the philosopher's chair, and dreams that he is dictating a system of science, whilst he is only retailing a collection of anecdotes. A philosopher of this school has lately carried the doctrine of instinctive principles so far, as to attribute the superiority of man over the other animals chiefly to the great number of instincts with which his mind is endowed; and amongst these he reckons not, we believe, as characteristic of our species in contradistinction to other animals, but as part of the instinctive bundle in the largeness of which our superiority consists, "the voiding of urine and excrement, sneezing, retraction of the muscles upon the application of any painful stimulus, the moving of the eyelids and other parts of the body." These, he says, are effects of original instincts, and essential to the existence of young animals. With this writer instinct is sometimes represented as looking into futurity, and acting upon motives which have hitherto been considered as the province of reason and the characteristic of man: here the same instinct is confounded with irritation and mechanism; and if this mode of philosophising continue in fashion, we shall not be surprised to find men, beasts, birds, and vegetables, considered by some other writer as nothing more than different species of the same genus of beings, that are all actuated by the great and universal principle of instinct. If sneezing and the retraction of the muscles upon the application of any painful stimulus be actions of instinct, there cannot be a doubt, upon the received principles of philosophy, but that the contraction of the leaves of the sensitive plant upon the application of any stimulus proceeds likewise from instinct. Nay, a pieoe of leather must be endowed with instinct; for it too retracts upon the application of the painful stimulus of fire. All these are evidently similar effects produced by the same or similar causes; for in the operations of sneezing and retracting the muscles upon any painful application, there is not the least spontaneous exertion on our part, no co-operation of mind more than in the contraction of the leather and the plant. With respect to the voiding of urine and excrement, it is obvious that, at first, these operations are performed without any effort of spontaneity; and that a voluntary power over the muscles which are subservient to them is very gradually acquired. Urine and excrement irritate the bladder and guts, which are supplied with branches of the same nerves that supply the abdominal muscles. But it is well known that the irritation of one branch of a nerve brings on a contraction of thc muscles which are supplied by the other branches. Urine and excrement therefore are evidently expelled by the mechanical contractions of the organs of excretion; and to attribute these evacuations to instinct, is equally absurd as to say, that water or any other soft substance pent up in a vessel, and pressed equally on all sides, makes its escape by instinct through the easiest passage. It is difficult to guess what the author means by the instinctive motion of the eyelids and other parts of the body. There is a motion of the eyelids which is voluntary, and another which is involuntary. The former proceeds from some motive, to exclude too great a glare of light, or to guard the eye against a foreseen mischief, and is therefore the result of reason as distinguished from instinct: the latter is obviously the effect of association, which took place in early infancy, and produced a habit. Infants for several days after birth do not wink with their eyes upon the approach of one's hand or any other substance; but after having experienced pain from too much light, or any other thing which hurts the eye, and that pain having at first produced an automatic motion of the eyelids, the motion comes in time to be so closely associated with its cause, that the very appearance of the latter produces the former. In all this there is no instinct, nor any thing which resembles instinct: in the one case, the motion of the eyelids is in the strictest sense voluntary and rational; and in the other, it is either automatic or the effect of habit.

"The love of light," says the same writer, "is exhibited by infants at a very early period. I have remarked evident symptoms of this attachment on the third day after birth. When children are farther advanced, marks of the various passions generally appear. The passion of fear is discoverable at the age of two months. It is called forth by approaching the hand to the child's eye, and by any sudden motion or unusual noise." It has likewise been said, that "an infant may be put into a fright by an angry countenance, and soothed again by smiles and blandishments;" and "that all these are cases of pure instinct." In reply to which, we scruple not to assert with Dr Priestley, that an infant (unless by an infant be meant a child who has a good deal of experience, and of course has made many observations on the connections of things) "is absolutely incapable of terror. I am positive (says he), that no child ever shewed the least symptom of fear or apprehension till he had actually received hurts and had felt pain; and that children have no fear of any particular person or thing, but in consequence of some connection between that person or thing and the pain they have felt. If any instinct of this kind were more necessary than another, it would be the dread of fire. But every body must have observed, that infants shew no sign of any such thing; for they will as readily put their finger to the flame of a candle as to any thing else, till they have been burned. But after some painful experience of this kind, their dread of fire, though undeniably the effect of association, becomes as quick and as effectual in its operations as if it were an original instinctive principle." We moreover do not hesitate to say, with the same great philosopher, that if it were possible always to beat and terrify a child with a placid countenance, so as never to assume that appearance but in those circumstances, and always to soothe him with what we call an angry countenance, this connection of ideas would be reversed, and we should see the child frightened with a smile, and delighted with a frown. In fact, there is no more reason to believe that a child is naturally afraid of a frown, than that he is afraid of being in the dark; and of this children certainly discover no sign, till they have either found something disagreeable to them in the dark, or have been told there is something dreadful in it.

The truth of these observations is so obvious, that we doubt not but they will carry conviction to the mind of every reader. For though it should be granted, that so early as on the third day after birth children exhibit symptoms of uneasiness upon the sudden exclusion of light, it would by no means follow that the love of light is in them instinctive. Light operates upon the eye by contact, and communicates to the infant a sensation of touch. If that sensation be pleasant, the child must necessarily feel some degree of uneasiness upon its removal, just as a full-grown man must feel uneasy upon being deprived of any positive pleasure. But is sensation, or pleasure, or the removal of pleasure, pure instinct? No, surely.

Thus difficult is it to say, in many cases, what actions have their origin in instinct, and what are merely the effects of early association. But we think it may be safely affirmed, that no action, whether of man or brute, which is deliberately performed with a view to consequences, can with any propriety be said to proceed from instinct; for such actions are the effect of reason influenced by motives. Deliberation and instinct are obviously incompatible. To say with the author of the Philosophy of Natural History, "that, when we are stimulated by a particular instinct, instead of instantly obeying the impulse, another instinct arises in opposition, creates hesitation, and often totally extinguishes the original motive to action," is either to affirm what is apparently not true, or it is a gross perversion of language. Motives opposed to each other may create hesitation, and a powerful motive may counterbalance a feeble instinct; but of two or more instincts operating at the same time, and opposing each other, we have no conception. Instinct, if we choose to speak a language that is intelligible, means a certain impulse under the direction of Supreme Wisdom; and it is very little probable that such wisdom should give opposite impulses at the same instant. In the natural works of animals, which are confessedly under the influence of instinct, we perceive no symptoms of deliberation; but every one, when not interrupted by external violence, proceeds without hesitation in the direct road, to an end of which the animal itself knows nothing. The same would be the case with man were he under the guidance of instinct; and it is vain to say that the instinct of fear is daily counteracted by ambition and resentment, till it be proved that fear, ambition, and resentment, are really instincts. Of this, however, the author seems to have no doubt. Indeed, his work is so liberally stored with those principles, so useful to every man who wishes to acquire the name of a philosopher without the labour of investigation, that not only fear, ambition, and resentment, but even superstition, devotion, respect for eminent characters, avarice, hope, envy, benevolence, and sympathy, are all, in his opinion, instincts simple or modified. The origin of fear we have already seen when examining the instincts said to exhibit themselves in early infancy: let us try if we cannot trace some other individuals of this numerous family to the same source of early associations.

The case then seems to be as follows. We first perceive or suppose some real good, that is, some fitness to promote our happiness, in those things which we love or desire. Hence we annex to those things the idea of pleasure; with which they come, in time, to be so closely associated in our minds, that they cannot ever after present themselves without bringing that idea along with them. This association likewise often remains even after that which first gave rise to it is quite forgotton, or perhaps does not exist. An instance or two will make this very clear. No man can be born a lover of money; for in a state of nature money exists not: no man, therefore, can be born with our author's instinct of avarice, directed in the manner which the most common acceptation of that word denotes. Yet how many men are there in the world, who have as strong a desire for money as if that desire were innate and instinctive; who account so much money so much happiness; and who make the mere possession of gold and silver, without any thought or design of using them, the ultimate end of all their actions? This is not because the love of money is born with them, for that is impossible; but because they first perceive a great many advantages from the possession of money, whence they conceive a pleasure in having it. Hence they desire it, endeavour to obtain it, and feel an actual pleasure in obtaining and possessing it. Then, by dropping the intermediate steps between money and happiness, they join money and happiness immediately together, and content themselves with the fantastic pleasure of having it; making that which was at first pursued only as a means, be to them an ultimate end, in which consists their happiness or misery. The same might be observed concerning the thirst after knowledge, fame, ambition, and most of the various pursuits of life. These are at first entered upon with a view to some further end, but at length become habitual exercises; with which the idea of pleasure is so closely associated, that we continue the pursuit after the reason from which it was at first begun, has entirely vanished from our minds. Hence also we may account for another of our author's modified instincts, the almost diabolical feeling of envy. Mr Locke observes, that there are some men entirely unacquainted with this passion. His observations we believe to be a just one; for most men that are used to reflection, remember the time when they were first under its influence; and though they did not, it is a thing very little likely that the beneficent Author of nature should have implanted in the human mind even the seeds of an instinct, which, in the emphatic language of The Rambler, "is mere unmixed and genuine evil." Envy is that pain which arises in the mind upon observing the success or prosperity of others; not however of all others indefinitely, but only of those with whom, upon some account or other, the envious person has once had a rivalship. But of such a feeling the origin is obvious; for when two or more persons are competitors for the same thing, the success of the one necessarily tends to the detriment of the other: hence the success of the one rival is in the mind of the other closely associated with pain or misery; and this association remaining after the rivalship which occasioned it has ceased, the person in whose mind envy is thus generated, always feels pain at the success of his rival even in affairs which have no relation to the original competition. Thus it is, that we are apt to envy those persons who refuse to be guided by our judgments, or persuaded by our arguments: for this is nothing else than a rivalship about the superiority of judgment; and we take a secret pride, both to let the world see, and in imagining ourselves, that in perspicuity and strength of judgment we have no superior.

Though the principle of association will be more fully explained in another place, there is one observation which must not be omitted here; it is, that we do not always, nor perhaps for the most part, make these associations ourselves, but learn them from others in very early life. We annex happiness or misery to certain things or actions, because we see it done by our parents or companions; and acquire principles of action by imitating those whom we esteem, or by being told, by those in whom we have been taught to place confidence, that such conduct will promote our happiness, and that the reverse will involve us in misery. Hence the son too often inherits both the vices and the virtues of his father as well as his estate; hence national virtues and vices, dispositions and opinions; and hence too it is, that habits formed before the period of distinct remembrance are so generally mistaken for natural instincts.

From the whole, then, of this investigation, we think ourselves warranted to conclude, that there is an essential difference between mechanism and instinct, and between both and reason; that mankind perform actions by each of these principles, and that those actions ought to be carefully distinguished, and though the human mind is unquestionably endowed with a few instincts necessary to the preservation of the individual and the propagation of the race, that by far the greater part of those actions which are commonly said to proceed from instinct are merely the effects of early habits. We are likewise of opinion, that the present fashionable mode of referring almost every phenomenon in human nature to a particular instinct as its ultimate cause, is hurtful to science, as tending to check all further inquiry; and dangerous in morals, as making people implicitly follow, as the dictates of nature and nature's God, the absurd superstitious or impious customs of their respective countries.

Having reprinted the foregoing article, written for a former edition, as containing a pretty full view of opinions (which is one of the most useful purposes of a work of this kind) on a subject of great curiosity and interest in philosophical speculation; we cannot do better than enlarge that view, by subjoining the following admirable observations, conceived in the spirit of genuine philosophy, from Mr Stewart's comparison between the faculties of man and those of the lower animals, in the third volume of his Philosophy of the Mind.

"That the brutes are under the more immediate guidance of Nature, while man is left, in a great degree, to regulate his own destiny by the exercise of his reason, is a fact too obvious to stand in need of illustration. In what manner, indeed, Nature operates in this instance, we are wholly ignorant; but nothing can be more certain than this, that it is not by a deliberate choice, analogous to what we experience in ourselves, that the lower animals are determined to the pursuit of particular ends; nor by any process analogous to our reason that they combine means in order to attain them.

"To that unknown, but obviously intelligent, cause which guides the operations of the brutes, we give the name of Instinct, without presuming to decide the question *where* this intelligence resides;—much in the same manner in which we give the name of the letters x and y to the unknown quantities in an algebraical problem. The circumstances by which it is distinguished from reason are so remarkable, and so manifest to the most careless observer, as to preclude, among candid inquirers, the possibility of dispute. Of these circumstances, the two following seem to be the most important: 1. The uniformity with which it proceeds in all individuals of the same species; and, 2. The unerring certainty with which it performs its office prior to all experience. In both these respects the operations of *reason* or *art*, properly so called, seem to be essentially different from any thing else that is known among animated natures; inasmuch as no two individuals of our species were ever observed to employ exactly the same combinations of means (at least where the means were at all complicated) for the attainment of the same ends; and as the capacity of reason, destitute of the aid of experience, is altogether a barren and unavailing principle.

"The disposition which some late authors have shewn to explain away the operations of instinct in man, can be accounted for only by their wish to weaken the foundations of natural religion. To speak of instincts and of original propensities, we have been told, is the language of mysticism. It is, in truth, the language of genuine science, which contents itself with a statement and generalization of facts, and stops short as soon as it arrived at the limits prescribed to human curiosity. The charge of Mysticism properly falls on those who, in attempting to conceal their ignorance from themselves or from others by means of theoretical expressions, darken the study of nature by words without knowledge.[1]

"In offering these remarks, I would not be understood to disapprove of the attempts of some late authors to analyse the various operations which are commonly referred to the general principle of instinct. But I must beg leave to remind them, that how far soever we may push the analysis, we must at last arrive at some *fact*, no less wonderful than those we mean to explain. Thus, although it should be made to appear, that the actions which a child performs at birth are learned by the *fœtus in utero*, we must still ad-

[1] "What Sir Isaac Newton has said in justification of the word *gravity*, as employed in his philosophy, against the objections of those who accused him of reviving the *occult qualities* of the Aristotelians, may be applied equally to the word *instinct*, as it is used in our present argument. 'These are manifest qualities, and their causes only are *occult*. And the Aristotelians give the name of occult qualities not to manifest qualities, but to such qualities only as they *supposed* to lie hid in bodies, and to be the unknown causes of manifest effects.' (Newton's *Optics*.)

mit, as an ultimate fact, the existence of an original determination to a particular mode of action salutary or necessary to the animal; and all that we have accomplished is to refer the origin of this instinct to an earlier period in the history of the human mind.

"In a very curious and original work, published about thirty years ago, under the title of *Zoonomia*, much ingenuity has been employed, and in several instances with great success, in analyzing those phenomena which are commonly referred to instinct; more particularly in attempting to account for the wonderful efforts which the human infant is enabled to make for its own preservation the moment after its introduction to the light.[1] Thus, it is observed, that the *fœtus*, while still in the *uterus*, learns to perform the operation of swallowing, and to relieve itself, by change of posture, from the irksomeness of continued rest; and, therefore (if we admit these propositions), we must conclude, that some of the actions which infants are vulgarly supposed to perform in consequence of instincts coeval with birth, are only a continuation of actions to which they are determined at an earlier period of their being. The remark is ingenious, and probably just, but it does not prove that *instinct* is an unphilosophical term; nor does it render the operations of the infant less mysterious than they seem to be on the common supposition. It only places these operations in a new light, and, I might perhaps venture to add, in a light more striking than they were viewed in before.

"The same author has attempted to account, in a manner somewhat similar, for the different degrees in which the young of the different animals are able, at the moment of birth, to exert their bodily powers. Thus calves and chickens are able to walk almost immediately, while the human infant, even in the most favourable situations, is six or even twelve months old before he can stand alone. For this Dr Darwin assigns two causes; 1*st*, That the young of some animals come into the world in a more complete state than those of others; the colt and lamb, for example, enjoying, in this respect, a striking advantage over the puppy and the rabbit. 2*d*, That the mode of walking of some animals coincides more perfectly than that of others with the previous motions of the *fœtus in utero*. The struggles of all animals, he observes, in the womb must resemble their manner of swimming, as by this kind of motion they can best change their attitude in water. But the swimming of the calf and of the chicken resembles their ordinary movements on the ground, which they have thus learned in part to execute while concealed from our observation; whereas the swimming of the human infant, differing totally from his manner of walking, he has no opportunity of acquiring the last of these arts till he is exposed to our view. The theory is plausible, and does honour to the author's sagacity; but, as I observed in a former instance, it only places in a new light that provident care which Nature has taken of all her offspring in the infancy of their existence.

"Another instance may contribute towards a more ample illustration of the same subject. A lamb, not many minutes after it is dropped, proceeds to search for its nourishment in that spot where alone it is to be found, applying both its limbs and its eyes to their respective offices. The peasant observes the fact, and gives the name of *instinct*, or some corresponding term, to the unknown principle by which the animal is guided. On a more accurate examination of circumstances, the philosopher finds reason to conclude, that it is by the sense of *smelling* it is thus directed to its object. In proof of this, among other curious facts, the following has been quoted: 'On dissecting,' says Galen, 'a goat with young, I found a brisk *embryon*, and having detached it from the *matrix*, and snatched it away before it saw its dam, I brought it into a room, where there were many vessels, some filled with wine, others with oil, some with honey, others with milk, or some other liquor, and in others there were grains and fruits. We first observed the young animal get upon its feet and walk; then it shook itself, and afterwards scratched its side with one of its feet; then we saw it smelling to every one of those things that were set in the room, and when it had smelt to them all, it drank up the milk.'[2] Admitting this very beautiful story to be true, (and, for my own part, I am far from being disposed to question its probability), it only enables us to state the fact with a little more precision, in consequence of our having ascertained that it is to the sense of smelling the instinctive determination is attached. The conclusion of the peasant is not here at variance with that of the philosopher. It differs only in this, that he expresses himself in those general terms which are suited to his ignorance of the particular process by which nature in this case accomplishes her end; and if he did otherwise, he would be censurable for prejudging a question of which he is incompetent to form an accurate opinion. A person who is totally unacquainted with anatomy, may nevertheless admire (and may admire on as good grounds as Cuvier himself) the mechanism of the human hand, or of the elephant's proboscis.

"The foregoing observations on the instincts of the new-born kid are strictly applicable to the attempts which have been made to account for the instincts of migratory birds and fishes, by changes in their sensations produced by the vicissitudes of the seasons. Of these attempts I have met with none which seem to me at all satisfactory; at the same time I have no doubt that it is by some physical means that the effect is accomplished, and I think it highly probable that new lights will be thrown on the subject by the researches of future naturalists.[3] But whatever success may attend their inquiries, the provident arrangements thus made for the preservation of animals must still be referred, not to their own foresight and sagacity, but to the wisdom and beneficence of Nature; and the questions so nobly and philosophically expressed by the poet will still remain, and, we may venture to predict, will for ever remain (as to their essential import) in all their force.

'Who bade the stork Columbus-like explore
Heavens not his own, and worlds unknown before?

[1] "*Biographical Memoirs of Smith, Robertson, and Reid*, p. 475. From the last of these Memoirs several of the following paragraphs are transcribed."

[2] *Darwin*, vol. i. pp. 195, 196.

[3] "From some observations made by Dr Jenner, in prosecution of a suggestion thrown out by the celebrated John Hunter, it seems now to be completely established, that, in the case of migrating birds, the inciting causes of migration are certain periodical changes in the testes and ovaria of the male and female.

"The fact is extremely curious, but offers no explanation whatever of the grand problem: it may account for the bird's restlessness and desire to change its abode; but the same difficulty still recurs, and only meets us in a new form. How are we to explain the invariable flights of the bird towards a particular *unknown* region? For it must not be forgotten that its migrating instinct has at once a reference to a period of the season in the country which it leaves, and to that in the country for which it is bound. Of this I have no doubt that both these ingenious authors were fully aware. (*Observations on the Migration of Birds*, by Edward Jenner, M.D. F.R.S. *Philosophical Transactions of the Royal Society of London* for the year 1824, Part I. See also the late Mr John Hunter's *Observations on certain parts of the Animal Economy*.)"

Who calls the council, states the certain day,
Who forms the phalanx, and who points the way?'[1]

The sophistry which runs through Darwin's reasonings concerning instinct, is partly owing to the unauthorized and arbitrary meaning which he has annexed to that word.

"'By a due attention to these circumstances,' he observes, 'many of the actions of young animals which, at first sight, seemed only referable to an inexplicable instinct, will appear to have been acquired, like all other animal actions that are attended with consciousness, *by the repeated efforts of our muscles, under the conduct of our sensations or desires*.'[2]

"Our sensations and desires (it is to be observed) are admitted by Darwin 'to constitute a part of our system, as our muscles and bones constitute another part; and hence,' says he, 'they may alike be termed *natural* or *connate*, but neither of them can properly be termed *instinctive*, as the word *instinct*, in its usual acceptation, refers only to the *actions* of animals. The reader,' continues Darwin, 'is intreated carefully to attend to this definition of *instinctive action*, lest by using the word *instinct* without adjoining any accurate idea to it, he may include the natural desires of love and nunger, and the natural sensations of pain and pleasure under this general term.'[3]

"According to this explanation, the difference of opinion between Dr Darwin and his opponents is chiefly verbal; for whether we consider the actions of animals commonly referred to *instinct*, as the immediate result of implanted determinations, or as the result of *sensations and desires* which are *natural or connate*, they afford equally manifestations of design and wisdom in the Author of their being, inasmuch as, on both suppositions, they depend on causes either mediately or immediately subservient to the preservation of the creatures to which they belong. On both suppositions, there is an infallible provision and preparation made by the hand of Nature for the effect which she has in view.

"I was glad to find that the same remark on this part of Darwin's theory had been previously made by Dr Paley. 'I am not ignorant,' says he, 'of the theory which resolves instinet into sensation. . . . Thus the incubation of eggs is accounted for by the pleasure which the bird is supposed to reeeive from the pressure of the smooth convex surface of the shells against the *abdomen*, or by the relief which the mild temperature of the egg may afford to the heat of the lower part of the body, which is observed *at this time* to be increased beyond its usual state. . . . In this way of considering the subject, sensation supplies the place of foresight; but this is the effect of foresight on the part of the Creator. Let it be allowed, for example, that the hen is induced to brood on her eggs by the enjoyment or relief which, in the heated state of her *abdomen*, she experiences from the pressure of smooth round surfaces, or from the application of a temperate warmth. How comes this extraordinary heat or itching, or call it what you will, which you suppose to be the cause of the bird's inclination, to be felt just at the time when the inclination itself is wanted, when it tallies so exactly with the internal constitution of the egg, and with the help which that constitution requires in order to bring it to maturity? In my opinion this solution, if it be accepted as to the fact, ought to increase, rather than otherwise, our admiration of the contrivance.'"

INSTITUTES, a book containing the elements of the Roman law. See CIVIL LAW.

National INSTITUTE of France, was founded by a decree of the new constitution, and opened on the 7th of December 1795. The abolition of royalty naturally suggested to the democratic rulers of France, that it would likewise be proper to abolish every thing which had the remotest connexion with it. Condorcet therefore proposed that the seven old academies, which had the term *royal* prefixed to them, should give way to the establishment of one new academy of arts and sciences, under the title of the *National Institute*.

The Academy, or Institute, was to consist of two hundred and eighty-eight members, the half of whom were to have their residence in Paris, and the rest in the different departments, with twenty-four foreign members.

This academy was divided into three classes; these were subdivided into sections, and each of these again consisted of twelve members. The *first class*, consisting of ten sections, were to preside over mathematics, mechanical arts, astronomy, experimental philosophy, chemistry, natural history, botany, anatomy and animal history, medicine and surgery, animal economy, and the veterinary science. The *second class*, having for its department morality and politics, consisted of six sections, viz. analysis of sensations and ideas, morals, legislature, political economy, history, and geography. The *third class*, consisting of eight sections, presided over literature and the fine arts, viz. universal grammar, ancient languages, poetry, antiquities, painting, sculpture, architecture, and music. Several volumes of memoirs have been published by each of the classes.

The Institute was new-modelled by Napoleon in 1806, and again on the return of the Bourbons. By a decree of the 21st of March 1816, it was ordered that the Institute should be composed of four academies; viz. the French Academy, the Royal Academy of Inscriptions and Belles Lettres, the Royal Academy of Scienees, and the Royal Academy of Fine Arts. Some alterations were at the same time made in the number of members, and in other particulars.

INSTITUTION, in general, signifies the establishing or founding of something. In the canon and common law, it signifies the investing a clerk with the spiritualities of a rectory or other preferment, which is done by the bishop, who uses the following formula: "I institute you rector of such a church with the cure of souls, and receive your care and mine."

INSTITUTIONS, in literary matters, denote a system of elements or rules of any art or science. Thus physical or medical institutions are such as teach the *præcognita* necessary to the praetice of medicine, or to the cure of diseases.

INSTRUMENT, in general, whatever is subservient to a cause in producing any effect.

INSTRUMENT is also used in law to signify some public act, or authentic deed, by means of whieh any truth is made apparent, or any right or title established, in a court of justice.

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[1] *Essay on Man.* [2] *Zoonomia*, vol. i. p. 189, third edition corrected, 1801.

[3] *Zoonomia*, vol. i. p. 188, third edition corrected, 1801.

"Were this very arbitrary limitation of the word *Instinct* adopted, we should be forced to reject as improper, the employment of that term in the passage formerly quoted from Mr Smith, in which he speaks of the *instinctive perception* of distance from the eye in certain classes of animals. The same use of the word occurs in various other parts of his works. 'There seems,' he observes on one occasion, 'to be in young children an *instinctive* disposition to believe whatever they are told.' And a few pages afterwards, 'The desire of being believed, the desire of persuading, leading, and directing other people, seems to be the strongest of all our natural desires. It is perhaps the *instinct* upon which is founded the faculty of speech, the characteristical faculty of human nature.' (*Theory of Moral Sentiments*, vol. ii. pp. 382, 384, sixth edition.) As an authority for the *usual acceptation* of a philosophical term, Mr Smith will be allowed to rank somewhat higher than Dr Darwin."

INSURANCE.

Insurance. INSURANCE is a contract of indemnity, by which one party engages, for a stipulated sum, to insure another against a risk to which he is exposed. It is of three kinds, viz. Fire, Life, and Marine; all of them producing similar results by very different means. The party who undertakes the risk is called the insurer, assurer, or underwriter, and the party protected by the insurance is called the insured or assured; the sum paid is called the premium, and the instrument containing the contract is termed the policy.

I.—FIRE INSURANCE.

Fire insurance. This species of insurance has been practised in Great Britain for nearly a century and a half, and is now, notwithstanding the heavy duty imposed upon it, of almost universal use, particularly in our cities and large country towns. Though practised in France, Holland, Austria, and other countries on the Continent, it is not general anywhere except in Great Britain; and in this country fire insurance is not confined to subjects within the realm, or even to our colonies, but is extended to risks of all descriptions, and in every quarter of the world. Indeed, of late years foreign fire insurance has become a most important addition to the extensive transactions of some of the principal London establishments, a very considerable portion of their premiums being derived from insurances effected in other countries.

Insurance against fire is that contract by which the insurer, in consideration of a certain premium received by him, undertakes to indemnify the insured against all losses or damage which he may sustain by fire, within a limited period, in his houses, warehouses, merchandise, or other property. Insurances of this description are generally made by joint-stock companies, of which the principal are in London, though there are now several in almost all the large towns throughout the kingdom; and there is scarcely a village in which there are not some of their branches and agents. Most of these insure at their own risk, and for their own profit; in a few of them, however, called contribution societies, every person insured becomes a proprietor, and participates in the profit or loss of the concern.

The only society of this description in Scotland is the Friendly Insurance Incorporation, which was also the first established company in this part of the island for insurance against loss by fire. In 1720 there had been some disastrous fires in Edinburgh, by which many individuals sustained great loss of property; and in the same year a meeting of inhabitants took place, for the purpose of founding a society for their mutual protection from loss in cases of fire. A certain per-centage of premium upon the sum insured by each proprietor or contributor was paid for a perpetual insurance on their properties, and these premiums formed the capital stock of the concern. The corporation, however, much more than answered the purpose which those interested in its formation had in view; for, after the payment of all claims for loss, the capital, by judicious management, had accumulated to such an extent, that in 1760 it was resolved no longer to limit the business to Edinburgh and Leith, but to extend it over Scotland, and upon every description of property, on the principles now followed by other insurance companies.

The rules by which these establishments are governed, and the conditions on which they insure, are made by their own directors; and as a copy of these conditions is printed upon the policy, and forms a part of the contract therein contained, the insured is understood, by his acquiescence, to submit to their proposals, and is fully apprized of those rules, upon the compliance or non-compliance with which, he will or will not be entitled to an indemnity.

Fire Insurance.

Laws. The construction to be put upon the regulations of the various offices has but seldom become the subject of judicial inquiry; and the law of the case, in as far as it has been ascertained by precedent, is of course embraced by all of them.

1. The insurers must be made fully acquainted with the nature of the risk they are required to cover. Any misrepresentation in describing the building or goods, or the process of manufacture carried on, whereby the same may be charged at a lower rate of premium than they would otherwise be, invalidates the policy; and if any alteration be made in the state of the building or process of manufacture after the insurance is effected, the insured is required to give due notice thereof to the insurers, as, in default, he will be unable to recover under his policy. Concealment, too, is not less fatal to the contract than positive misrepresentation. A policy was effected at the Phœnix Fire Office on the 25th of July 1814, "on a warehouse in the lower town of Heligoland, for three months, as by letter of 11th July 1814." It appeared that the person applying for insurance had two warehouses in Heligoland, one of them separated by another building from a boat-builder's workshop, in which a fire broke out at seven in the evening of the 11th July, but apparently was almost immediately extinguished. The same evening after this had occurred, the insured wrote to London for a three months' insurance of L.400 on the warehouse near the boat-builder's, and L.3500 on coffee therein. The mail was shut; but the master of the packet took the letter to Cuxhaven, and there put it into the post-office. The insurance was effected without any disclosure of what had happened. Early in the morning of the 13th a fire again broke out in the boat-builder's, and destroyed the adjoining warehouse, with its contents. The jury, though they acquitted the plaintiff of any fraudulent intention, thought that the fire of the 11th ought to have been communicated, and therefore found for the defendant. Bufe *v.* Turner, 1814.

2. Nothing can be recovered from the insurers in the event of loss, unless the party insuring had an interest or property in the thing insured at the time when the insurance was effected, and when the loss happened. Any trustee, mortgagee, reversioner, factor, or agent, however, has sufficient interest in the goods under his custody to effect a policy of insurance, provided the nature of such interest be distinctly specified at the time of executing such policy. In the same manner, it is customary for hotel and inn-keepers to insure the property of their lodgers; of the masters of boarding-houses to insure that of their scholars; of salesmen and auctioneers to insure merchandise, furniture, &c. whilst about to be disposed of in their premises; and so forth.

There is reason to believe that frequent frauds are perpetrated by individuals insuring to a large amount property of trifling value; and it is an undoubted fact that fraudulent and excessive claims are of constant occurrence. These have been very much increased by the competition and keenness for business which have existed amongst the offices for some years past. But parties are not always aware, that in tendering such a claim, they are running the risk of *forfeiting all right under their policy.* This was decided in 1832 in the case of Friedlander *v.* the London Assurance Company, where, although it was not denied that loss and damage had been occasioned by fire, and that not arising from improper means, still, from the extravagance of the claim made by the pursuer, it was held to be a fraudulent valuation, and a verdict was consequently given against him. No reliance can be placed on the oath of a suspected claimant; if a man make out a fraudulent claim, he will not be very scrupulous in swearing to its correctness.

On the other hand, where a loss has occurred, and there is no suspicion of any unfair practice on the part of the insured, it is the duty of the insurers to be generous and liberal. The insured is always put to much inconvenience, and frequently to serious loss beyond what he can claim for under his policy; and therefore a fair sufferer ought to be promptly and cheerfully settled with.

3. In general there is an exception in favour of the insurers in cases of fire occasioned by "invasion, foreign enemy, civil commotion, riot, or any military or usurped power whatever." The terms "civil commotion and riot" were introduced in consequence of its having been found that the term "usurped power" means an invasion from abroad, or an internal rebellion, not the power of a common mob. The offices likewise, with propriety, decline paying losses on hay or corn occasioned by spontaneous combustion, though they make good the loss of any other property in consequence of such fire; it being the interest of the community at large to put down all such occasions of loss as are contained in the former, and negligence generally being the cause that damage is sustained in the latter. The offices, however, pay all loss by fire occasioned by lightning, as well as, *primo loco*, all losses caused by incendiarism, though in this last case they have a claim on the county for indemnification.

4. "Books of accounts, written securities, bills, bonds, tallies, and ready money," are naturally not the proper subjects of insurance, and are therefore excepted by all the offices; many adding to this list "gunpowder."

5. China, glass, crockery, and mirrors, are usually made the subject of a distinct item in a policy of insurance; and, from their fragile nature, are always charged as doubly hazardous. The rate for "curiosities" is the same. Pictures and prints are generally taken at single hazardous; but when a very valuable collection is insured, the offices usually require a catalogue, with a distinct value attached to each. Jewels, trinkets, mathematical and musical instruments, are by some offices also required to be valued separately, and in that case are charged single hazardous. Generally, however, these are considered as common risks, and are included along with printed books, linen, and liquors, in one item with "household furniture."

6. It often occurs that no one office will insure to the full amount required by an individual who has large property; and in such cases the party, to cover his whole interest, is obliged to insure at different offices. But in order to prevent the frauds that might be practised by insuring the full value in various offices, there is, in the proposals issued by all the companies, an article which declares that persons insuring must give notice of any other insurance made on their behalf elsewhere upon the same houses or goods, that the same may be specified and allowed by indorsement on the policy, in order that each office may bear its rateable proportion of any loss that may happen; and unless such notice be given of each insurance to the office where another insurance is made on the same effects, the insurance made without such notice will be void. Different people, however, may have different interests in the same property, and each may insure his own interest without communication with the others.

7. An important condition in the proposals is that referring to the proof of loss. Most offices make it a condition that the individual claiming shall procure a certificate under the hands of some reputable householders, and minister of the parish, to the satisfaction of the company, importing that they are acquainted with the character and circumstances of the person insured, and do know, or verily believe, that he really, and by misfortune, without any kind of fraud or evil practice, has sustained, by such fire, loss and damage to the amount therein mentioned. This condition has given rise to a great deal of discussion in the courts; but it has been finally settled, that the procuring of the certificate is a condition *precedent* to the payment of any loss, and that its being wrongfully refused will not excuse the want of it.

8. On bespeaking policies, the insured are required either to pay the premium, or make a deposit for the same; the Phœnix and most other offices conditioning, that unless an interim-receipt for such payment has been issued, either by the office or one of its agents, no order for insurance shall be held as in force. Fifteen days are allowed at the expiration of each year for the payment of the premium for the next year in succession, upon all annual policies, and others for a longer period; and, provided the premium be paid within that time, the insured is considered as under the protection of the office. But the Phœnix and other offices always expressly declare, in all policies for a shorter period than a year, that the insurance ceases at six o'clock in the evening of the day mentioned therein. If, however, either the insurers or the insured intimate, during the continuance of a policy, their intention of dropping the contract at the expiration of the year, it has been decided, that a loss happening within the fifteen days after the end of the year does not in such a case fall under the contract.

9. A policy of insurance is not in its nature assignable, nor can it in England be transferred without the express consent of the office. In Scotland every pecuniary obligation is assignable; but there being something of the nature of a *delectus personæ* in this contract, the power of assignment is, by the terms of the policy, put under particular restraints. When, however, any person dies, his interest remains in his executors or administrators respectively, who succeed or become entitled to the property, provided such representatives procure their right to be indorsed on the policy. In the same way, no one who sustains a loss on stock or merchandise in premises to which he has removed since his policy was extended, has a valid claim, if such change be not indorsed on the policy in question. On bankruptcy the creditors are entitled to the full benefit of the policy, provided the premium has been duly paid up.

10. The insurers are liable, not only for loss by burning, but for all damage or injury caused by the accident, as well as for all reasonable charges attending the removal of articles which may never have been touched by the fire; as, for instance, in the case of the gable of a house falling across a street, and damaging the property on the opposite side, or in the case of destruction done to fine goods by the smoke of a conflagration in the vicinity, or from the water which may have been thrown about in endeavouring to extinguish it. In such cases the insurers are distinctly liable; but as their contract is one of indemnification only "for loss or damage by fire," there must have been actual ignition to entitle the insured to recover, it not being sufficient that there has been a great and injurious increase of heat, whilst nothing has taken fire which ought not to be on fire. For example, in one case of a sugar-house, in which, for the purposes of the manufacture, heat was communicated to each of the separate stories by a chimney, forming nearly one side of the house, at the top of which there was a register; the neglect to open this register on one occasion caused an excessive heat, which blackened the walls, and injured the sugar in different states of preparation; but the damage thus sustained was held not to come under the spirit of the contract.

11. The loss by fire is scarcely ever a total loss, and the valuation in the policy is only the fixing of a maximum, be-

yond which the underwriters are not to be liable, and not the conclusive ascertainment of the value to be replaced. There is no such thing in this contract as the "average" in marine insurance; the amount insured is payable to its full extent, without (unless otherwise stipulated) any reference to the value of the subject insured, either in itself, or in comparison with such parts of it as have been saved; at least such is the practice in Great Britain, but on the Continent all policies are subject to average. The loss is generally settled by arbitration, and a clause of reference is consequently inserted in most policies. The company, however, generally retain the right of either reinstating the subject lost or damaged, or of paying its value.

Insurances are generally divided into *common*, *hazardous*, *double hazardous*, and *special*. The charge for insuring property of the first description is now usually 1s. 6d. per cent., the second 2s. 6d., the third 4s. 6d., whilst the fourth, as its name denotes, comprehends those extra risks which are made the subject of special agreement between the parties.

It is almost impossible to form a correct classification of the risks comprehended under these heads, as the higher risks not only vary most materially in themselves, but in one large town it is well known that losses are constantly occurring upon a species of risk which in another is rarely or never the cause of a fire. But as the law of average is a fundamental principle in insurance, and can only be derived from observations made on a very large scale, the tables published by most offices are formed principally from experience.

The table of minimum premiums agreed to by several of the Scotch offices in 1830 is as follows:

Premium per cent.	s.	d.
Apothecaries	4	6
Bookbinders	5	0
Booksellers	2	0
Cart or wheel-wrights, without stove	5	0
Ditto with stove	10	6
Calenderers	3	0
Ditto with steam-engine	4	6
Cotton-mills	14	0
Cotton wool	2	6
Corn-mills without kiln	7	6
Ditto with kiln	10	6
Distilleries with or without kiln, and all communicating therewith	10	6
Farm-stocking.		
Farm dwelling-house, slated or tiled, and detached from offices	2	0
Farm dwelling-house thatched	5	0
Slated or tiled offices	2	6
Thatched ditto	5	0
Stock in barn-yard, for the year	2	6
Ditto in ditto for shorter period	2	0
Ditto within risk of steam-engine	4	6
Flax-mills, warranted no carding of tow or heckling therein	16	0
Ditto with carding of tow	18	0
Ditto with the addition of heckling	20	0
Hotels and taverns	2	6
Hecklers, without artificial light	5	0
Ditto lighted from without	7	6
Ditto lighted from within	10	6
Jewellers, stock generally	3	0
Or, if divided, thus:—		
Plate and plated goods and cutlery	2	0
Stock of jewellery	4	6
Mansion-houses	2	0
Muslin goods in warehouse	2	0
Printers	5	0
Paper-mills heated by steam, no stove	5	0
Ditto with stoves having flues	21	0
Public libraries	2	0
Pawnbrokers	5	0
Power-loom factories	5	0
Retail spirit-dealers	2	6
Soap manufacturers	3	0
Ditto with steam-engine	4	6
Sugar-refiners.		
Old refinery, building	31	6
Stock and utensils	42	0
If any cockle, not covered with a brick arch, but only protected by a tile or metal covering, 5s. per cent. extra, for building and stock.		
Steam process only, building	16	0
Stock and utensils	21	0
Mixed process, building	25	0
Stock and utensils	31	6
Theatres, Edinburgh and Glasgow	31	6
Woollen-mills without stove	7	6
Ditto having one or two stoves	10	6
three or four stoves	12	6
five or more stoves	15	0
Wrights, house-carpenters, or cabinet-makers, without stove	10	6
With stove	15	0

Table showing the Premiums for Periods short of a Year, applicable to every species of risk, Farm Stocking excepted.

Yearly.			Six Months.			Three Months.			Yearly.			Six Months.			Three Months.		
£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
0	1	6	0	1	3	0	1	0	0	7	6	0	5	0	0	3	6
0	2	0	0	1	6	0	1	3	0	9	0	0	6	0	0	4	6
0	2	6	0	1	9	0	1	6	0	10	6	0	7	0	0	5	0
0	3	0	0	2	6	0	1	9	0	12	6	0	9	0	0	7	6
0	4	6	0	3	0	0	2	0	0	15	0	0	12	6	0	10	0
0	5	0	0	3	6	0	2	6	1	1	0	0	15	0	0	10	6
0	6	0	0	4	0	0	3	0									

The statute 55 Geo. III. c. 184, imposes on every policy a duty of one shilling, and also the annual sum of three shillings for every L.100 insured for a year, and according to that rate for any fractional part of L.100 insured, and for any fractional part of a year.

All property excepting farm stock and public hospitals is liable to this duty. It is collected by the offices along with their premiums, and they are allowed a drawback of five per cent. upon it for their trouble and expense in so doing. From the last returns, it appears that this duty amounts to nearly L.900,000 per annum, which shows that British property to the extent of at least six hundred millions sterling must be covered by our insurance offices.

Table of Duties paid to Government by the principal London Fire Offices.

Offices.	1827.	1828.	1829.	1830.	1831.	1832.	1833.	1834.
Alliance	L.17,746	L.19,095	L.19,466	L.20,175	L.20,715	L.20,147	L.20,428	L.21,034
Atlas	20,898	19,522	20,199	20,700	20,783	21,010	21,288	21,398
British	15,464	16,293	15,812	15,819	15,572	15,644	15,395	16,428
County	43,522	47,413	44,822	44,172	48,519	48,507	44,232	40,471
Globe	26,169	25,367	25,566	26,462	26,597	27,198	27,321	27,355
Guardian	29,063	29,684	30,595	31,077	31,885	31,528	31,916	32,114
Hand-in-Hand	11,704	11,975	11,254	11,589	11,564	10,960	10,793	10,950
Imperial	28,334	28,647	28,510	27,081	28,230	28,234	27,154	27,020
London	7,077	7,262	7,485	8,019	7,953	8,125	8,477	9,490
Palladium	4,721	5,028	5,378	1,377	Discontin.	......	......	......
Phœnix	60,482	62,839	65,649	68,875	69,390	75,076	73,368	72,821
Protector	35,273	46,446	54,287	56,081	59,789	59,182	57,858	56,676
Royal Exchange	38,034	49,416	49,786	51,891	54,586	54,824	55,716	55,266
Sun	111,521	114,205	118,856	120,619	124,030	124,127	124,681	127,470
Union	15,705	16,412	16,285	15,714	15,833	15,315	16,133	16,370
Westminster	14,359	14,264	15,461	14,777	15,116	15,111	15,126	15,531
Albion	12,869	Discontin.	......	......	.....	......	......	......
	L.492,948	L.513,868	L.529,411	L.534,428	L.550,562	L.554,988	L.549,886	L.550,394

Duties paid to Government by the English Country Fire Offices.

	1833.	1834.
Bath Sun	L.1,567	L.1,568
Birmingham	7,004	7,042
Birmingham District	...	147
Bristol	3,722	3,653
Bristol (Crown)	1,772	1,853
Bristol (Union)	2,566	2,552
Essex Economic	2,821	2,595
Essex and Suffolk	5,753	5,356
Hants, Sussex, and Dorset	2,598	2,598
Kent	9,978	10,290
Leeds and Yorkshire	8,458	8,966
Leicestershire	...	262
Manchester	17,726	18,318
Newcastle-upon-Tyne	2 qrs. 2,093	5,108
New Norwich Equitable	1,293	1,294
Norwich Equitable	2,647	2 qrs. 1,090
Norwich Union	61,345	59,826
Reading	196	202
Salamander	5,105	5,021
Salop	2,737	2,612
Sheffield	1,952	2,056
Shields (North and South)	764	758
Suffolk (East)	5,445	5,117
Suffolk (West)	6,199	5,781
West of England	27,445	27,128
Yorkshire	5,558	5,992
	L.186,744	L.187,185

Duties paid to Government by the Scotch Insurance Companies for the year ending 1st February 1835.

Aberdeen Town and County	L.1,510
Caledonian	4,716
County and City of Perth	705
Friendly Insurance	3,449
Forfar and Perthshire	1,790
Hercules	5,575
Insurance Company of Scotland	5,650
North British	6,876
Scottish Union	17,542
West of Scotland	3,799
	L.51,612

This, however, affords no criterion of the actual amount of risk undertaken by these offices. In the first place, because the duty on farm-stock having been repealed in 1833, that very extensive description of risk is not included in this calculation; and, secondly, because some of the offices underwrite foreign risks to a very large amount, and these are equally, by act of parliament, exempt from duty. Perhaps, therefore, the enormous sum of one thousand millions sterling does not greatly exceed the amount of property insured by our British fire establishments.

The advantages of fire insurance are too prominent to require any description here. It affords great comfort to individuals, and often preserves whole families from poverty and ruin. The destruction of a mansion-house, or the conflagration of a cotton-mill, is a calamity that would press heavily on even the richest. But when distributed amongst several individuals, each feels it proportionally less; and provided the number of those amongst whom it is distributed be very considerable, it occasions no sensible inconvenience to any one in particular. Hence the advantage of combining to lessen the injury arising from the accidental destruction of property; and it is the diffusion of the risk of loss over a wide surface, and its valuation, that forms the employment of those engaged in the business.

II. LIFE ASSURANCE.

The insurance, or assurance on lives, as it is now most generally termed, is the insurance of a certain sum of money to be paid in the event of a person named being alive at a certain time, or dying within a certain time, or to be paid within a certain time after the death of a person named, whenever that may happen.

Life assurance is comparatively of recent date in this country; for, although the Amicable Society was incorporated by charter as early as the reign of Queen Anne, it was not till the commencement of the present century that its beneficial effects came to be felt, and that as a business it was carried to so great an extent. The precarious dependence of a numerous family upon the life of a single person naturally induces the desire of seeking some protection against a calamity which, sooner or later, must befall them; and this, probably, suggested the first idea of insurances upon lives, as an expedient by which a pecuniary indemnity, at least, might be secured to the sufferers, sufficient to rescue them from the poverty and distress which otherwise awaited them. All professional persons, or those living on salaries or wages, such as lawyers, physicians, military and naval officers, clerks in public or private offices, &c., whose incomes must of course terminate with their lives, and many others who are either not possessed of capital, or cannot dispose of their capital at pleasure, must naturally be desirous of providing, as far as they may be able, for the comfortable subsistence of their families in the event of their death. Take, for example, a physician or lawyer, without fortune, but making perhaps L.1000 or L.2000 a year by his business, and suppose that he marries and has a family. If this individual attain to the average duration of human life, he may accumulate such a fortune as will provide for the adequate support of his family at his death. But who can presume to say that such will be the case; that he will not form one of the many exceptions to the general rule? And suppose that he were hurried into an untimely grave, his family would necessarily be destitute. Now it is against such calamitous contingencies that life assurance is intended to provide. An individual possessed of an income terminating at his death, agrees to pay a certain sum annually to an insurance office; and this office binds itself to pay to his family, at his death, a sum equivalent (under deduction of the expenses of management and the profits of the insurers) to what these annual contributions, accumulated at compound interest, would amount to, supposing the insured to reach the common and average term of human life. Though he were to die the day after the insurance was effected, his family would be as amply provided for, as it is likely they would be by his accumulations, were his life of the ordinary duration. In all cases, indeed, in which those insured die before attaining an average age, their gain is obvious. But even in those cases in which their lives are prolonged beyond the ordinary term, they are not losers; they then merely pay for security which they could not otherwise have possessed. During the whole period from the time when they effect their insurances, down to the time when they arrive at the mean duration of human life, they are protected against the risk of dying without leaving their families sufficiently provided for; and the sum which they pay after having passed this mean term, is nothing more than a fair compensation for the security they previously enjoyed.[1] To heirs of entail, clergymen, professional men, men in trade and business, and generally to all liferenters, life insurance is therefore peculiarly suited. By the same means also facilities are afforded for raising money on loan, creditors may in many cases obtain ultimate payment of their debts, and provisions in marriage settlements are secured.

Policies of this kind are most frequently granted by companies, on account of the greater security there is in large bodies of men, than it is easily possible to be attained by an individual when the policy may be of long continuance.

The premium of assurance is either a gross sum paid at once, or a sum paid down on the day that the contract is made, with an obligation to pay the same sum annually during the existence of the policy. The latter is the more general mode of assurance.

When a party is desirous of effecting an assurance, he receives from the office of the company a printed paper called a declaration, which he fills up with the name of the party to be assured, his age, the place and time of his birth, and place of his present residence, with certain particulars as to his health. To corroborate the statement, references are given to two or more persons well acquainted with the party, one of whom must be a medical man. The reasons for these precautions are obvious.

When the declaration has been thus completed, the person by whom the assurance is made makes his appearance at the office of the company, where he is interrogated as to the general state of his health, and a minute is entered in their books accordingly. The letter of the referees, with the declaration, are subsequently laid before the directors, who, from these documents, and information frequently derived from other sources, form their decision. On the payment of the premium a receipt is given, containing the number of the policy, which is then made out according to the declaration, signed by a certain number of directors, and delivered to the other party interested in it. If the person on whose life the assurance is made cannot appear before the directors, or any one appointed by them for that purpose, an additional sum is frequently charged for non-appearance. There is also a duty to be paid to government on each policy, in addition to the first year's premium; but the premium only is named in the policy, as on the future payment of this sum its existence depends.

A policy is assignable, and frequently forms a security for sums advanced, and not unfrequently becomes an object of sale. In these cases the holder of the policy pays the future premiums, and the advantage of a purchaser consists in holding a policy at a less premium than he must have paid at the present age of the party on whose life the assurance was made. Thus, supposing a policy to have been granted for the payment of L.1000 at the death of a party aged between thirty and thirty-one when the policy was made; if sold when the party is between fifty and fifty-one, the purchaser will have to pay L.26. 2s. 6d. annually during the existence of the policy; whereas, if he had taken out a policy at the present age of the party, his premium would be L.45. 11s. 8d.; and for the difference between these two sums, namely, L.19. 9s. 2d., a price is fixed on. The public sale of a policy, however, possesses this disadvantage, that the bidders are frequently unacquainted with the person on whose life the assurance is made; and, being liable to trouble and expense, to ascertain that he is alive at each payment of the premium, must require a deduction on this account, from what they might otherwise presume to be a compensation for the difference between the two premiums. Policies are in consequence sold at very disproportionate prices; and it is evident, that a policy must be most valuable to the party insured, and less so to others, according to their convenience of paying the premiums, and receiving proper information respecting the party in whose life and death they are interested.

On the death of the party on whom the claim depends, certain documents are required, such as the register of the burial of the deceased, and references to the medical persons or others who attended him in his last illness; and, if he effected the policy himself, the probate of his will, or, if it has been assigned to another, a copy of the assignment. The nature of his death must also be ascertained; as, in ease of any contravention of the conditions of assurance, the policy is vitiated. In the interval between the notice of the party's death, and the time assigned for the payment of the claim, which by most of the offices is fixed at three months, due investigation is made, and, every thing being found satisfactory, the claimant brings with him the policy, and a receipt for the sum claimed, which is immediately paid.

When a claim is payable in the event of a person being alive at a certain time, his appearance before the directors is requisite, or sufficient proof must be given that he was alive at the time defined by the policy. Policies de-

[1] See M'Culloch's *Commercial Dictionary*, art. *Insurance*.

Life Assurance.

pending on a person being alive at a certain time are very rare, and chiefly confined to endowments for children, in which case the payment of a gross sum down, or of an annual payment till the child attains the age of 14 or 21, secures to that child, at that age, the sum named in the policy.

For adjusting the premium to be paid according to the age of the party on whom the assurance is made, tables of rates have been formed, and those derived from the registers of mortality at Northampton and Carlisle are in general adopted. Tables of the duration of human life have also been made from observations in various other places; amongst which the most distinguished are those of De Parcieux, Kerseboom, Aikin, the registers of Sweden, Finland, and London; and one published within these few years by the Equitable Society, founded on the experience of that well-known establishment.

In the formation of these tables, a vulgar error is entertained, that they are dependent on chance; for life being uncertain, every attempt to regulate premiums is of no avail. It is true that life cannot be reduced to a certain scale, that is, if a thousand persons are named, it is impossible to state how many will die in each year, till the whole cease to exist. But if the observations are extended over a very large surface, and very numerous data are collected, the most accurate calculations may be made of the *probable* duration of any one life.

After a scale of life has been adopted, a table of premiums is derived from it by strict mathematical calculation, and in a very ingenious manner. Suppose the premium for a person of a certain age to be known, then the premium for a person of one year younger, being compounded of the premium for one year and the present value of the above premium, is easily calculated from the table of lives. The rule is this: Multiply the premium on the oldest life into the number of persons alive in the tables of that age, and divide by the number of persons of the younger age alive in the tables. This sum discounted for a year gives the premium for assuring the desired sum at the end of the year. Then multiply the sum to be assured into the number of persons of the younger age that die according to the tables in a year, and divide by the number of persons alive at that age, and this sum discounted for a year is the assurance of the sum for the first year, and, consequently, the two sums added together give the desired premium. Now, as the oldest person in the scale of life dies in the ensuing year, the premium on him is evidently the sum to be paid discounted for one year, and thence the premium for the age below is ascertained by the above rule; and so of every age in succession. No errors can be committed without detection, as every step is checked by a similar table drawn out for the value of an annuity at each age.

In a similar manner, tables are formed for the assurance of a sum payable at the death of one out of two persons, or at the death of the survivor of two persons, or at the death of one on the contingency of his surviving another, and so on.

The above rules give tables of rates for the payment of a gross premium; but as it is generally more convenient to pay an annual sum equivalent to it, a table of rates is made for this case, and it is formed by dividing the gross premium by the value of an annuity upon each age added to unity. If the annual premium were paid at the end of the year, the addition of unity would be unnecessary; but a policy is not granted till one premium is paid, and hence the necessity of the addition is obvious.

As premiums are settled from a fixed table of observations on life, it is evident that, as deaths never happen exactly in the order prescribed in the tables, there must arise either a surplus or deficiency of capital for the payment of the sums assured. From the care which has hitherto been taken in the choice of lives, and the high premium which the offices have been enabled to demand, all the old establishments have accumulated very large capitals; consequently, we believe it has never occurred that the proprietors have been called upon to make up a deficiency. It is in the management of this capital, or surplus, that life assurance companies differ. One of them, termed Proprietary Companies, undertake to pay *fixed* sums upon the death of the individual assuring with them; the profits made by such companies being wholly divided amongst the proprietors, their premiums are generally, or at least ought to be, lower than those of others. Of this class are the Pelican, Sun, and others, principally of old standing. The second class of life assurance companies are the Participating, which, instead of undertaking, like the former, to pay certain specified sums upon the death of the assured, allow the latter to participate, to a certain degree, along with the proprietors, in the profits made by the business. The mode in which this class allot their profits is not the same in all, as we shall immediately see; but in general their premiums are somewhat higher than those of the preceding, and are made to depend in a considerable degree on the amount of the profits set apart for the insurers. The Alliance, Guardian, and Rock, as well as a large portion of the new companies, are of this description; and latterly a considerable number of them have united their participating with their proprietary business, by publishing different scales of premiums to suit the wishes and intentions of individuals assuring. The third class are Mutual Assurance Companies, of which the Equitable of London is the groundwork and model. In this sort of company there is no proprietary body distinct from the assured. The latter, after deducting the expense of management, share amongst themselves the whole profits of the concern; and therefore, as all the surplus returns to themselves, their scales of premiums are naturally higher than that of either of the foregoing.

In the two last classes, where the surplus is made advantageous to the assured, either a sum is at certain periods added to each policy, or the premium is diminished. In both cases, a valuation is made of all the annual premiums, with the past and future expected accumulations, and also of the claims upon every policy. It is requisite, however, that the utmost care should be taken to secure to each policy the sum named in it, with every addition made to it; and hence a certain portion, generally a third or a fifth, of the surplus is constantly retained to guard against possible contingencies. This reservation occasions a singular anomaly in mutual assurance companies. In these all are partners, being guarantees to one another for the payment of their respective claims. The surplus arising from the excess of premiums, with their accumulations above the claims, evidently belongs to the whole of the company, and consequently each partner is entitled to a portion of it. But of this surplus, a third or fifth being constantly reserved, and each person at his death ceasing to be a partner, every person leaves behind him a portion for his successors. The third or fifth is therefore, we may say, without an owner; for a partner has not a right to it during his life, and his heirs or assignees have not a claim to it after his death.

Policies of life assurance must be on stamped paper, the duty being as follows:

Where the sum in the policy does not exceed L.50	L.0	2	6
L.50, but not exceeding L.100	0	5	0
Where it does not amount to L.500	1	0	0
Where it amounts to L.500 and not to L.1000	2	0	0
...1000 3000	3	0	0
...3000 5000	4	0	0
...5000 and upwards	5	0	0

The premiums required by the principal offices are exhibited in the following tables.

Age.	Amicable, Scot. Equitable, Widows' Fund.	Metropolitan.	Norwich Union.	Equitable.
	L. s. d.	L. s. d.	L. s. d.	L. s. d.
15	1 16 5	1 15 8	1 14 9	1 18 7
16	1 17 6	1 16 5	1 15 9	1 19 8
17	1 18 6	1 17 2	1 16 9	2 0 8
18	1 19 7	1 17 11	1 17 8	2 1 8
19	2 0 7	1 18 8	1 18 6	2 2 8
20	2 1 6	1 19 6	1 19 6	2 3 7
21	2 2 5	2 0 5	2 0 6	2 4 6
22	2 3 3	2 1 3	2 1 3	2 5 4
23	2 4 1	2 2 1	2 2 0	2 6 3
24	2 4 11	2 3 0	2 2 9	2 7 1
25	2 5 10	2 4 0	2 3 8	2 8 1
26	2 6 10	2 5 1	2 4 6	2 9 1
27	2 7 10	2 6 1	2 5 8	2 10 1
28	2 8 11	2 7 3	2 6 8	2 11 1
29	2 10 0	2 8 5	2 7 9	2 12 3
30	2 11 1	2 9 9	2 8 10	2 13 5
31	2 12 3	2 11 1	2 10 0	2 14 7
32	2 13 6	2 12 7	2 11 1	2 15 9
33	2 14 9	2 14 1	2 12 3	2 17 1
34	2 16 1	2 15 8	2 13 6	2 18 5
35	2 17 6	2 17 5	2 14 10	2 19 10
36	2 19 0	2 19 1	2 16 2	3 1 4
37	3 0 6	3 0 9	2 17 6	3 2 10
38	3 2 3	3 2 7	2 19 0	3 4 6
39	3 3 9	3 4 5	3 0 6	3 6 2
40	3 5 6	3 6 4	3 2 0	3 7 11
41	3 7 5	3 8 5	3 3 6	3 9 9
42	3 9 3	3 10 9	3 5 2	3 11 8
43	3 11 3	3 13 4	3 7 0	3 13 3
44	3 13 4	3 16 2	3 9 0	3 15 9
45	3 15 6	3 18 11	3 11 0	3 17 11
46	3 17 9	4 1 3	3 13 8	4 0 2
47	4 0 3	4 3 10	3 16 3	4 2 7
48	4 2 9	4 6 5	3 19 6	4 5 1
49	4 5 6	4 9 2	4 2 9	4 7 10
50	4 8 3	4 12 0	4 6 0	4 10 8
51	4 11 2	4 15 2	4 9 8	4 13 6
52	4 14 2	4 18 4	4 13 3	4 16 5
53	4 17 4	5 1 8	4 17 0	4 19 7
54	5 0 8	5 5 2	5 1 0	5 2 10
55	5 4 2	5 9 1	5 5 3	5 6 4
56	5 7 11	5 13 4	5 9 6	5 10 1
57	5 11 11	5 17 7	5 13 6	5 14 0
58	5 16 1	6 1 11	5 17 6	5 18 2
59	6 0 7	6 6 7	6 2 6	6 2 8
60	6 5 4	6 11 6	6 7 3	6 7 4

Age.	Caledonian.	Edinburgh Life.	Pelican.	Sun.	Standard.	Scottish Union.
	L. s. d.	L. s. d.	L. s. d.	L. s. d.	L. s. d.	L. s. d.
15	1 12 7	1 12 7	1 11 11	1 12 8	1 12 10	1 10 7
16	1 13 5	1 13 5	1 12 9	1 13 6	1 13 10	1 11 6
17	1 14 3	1 14 3	1 13 6	1 14 3	1 14 10	1 12 5
18	1 15 1	1 15 1	1 14 4	1 15 1	1 15 9	1 13 6
19	1 15 11	1 15 11	1 15 3	1 16 0	1 16 8	1 14 7
20	1 16 8	1 16 8	1 16 1	1 16 11	1 17 6	1 15 8
21	1 17 6	1 17 6	1 16 10	1 17 11	1 18 3	1 16 9
22	1 18 4	1 18 4	1 17 7	1 18 11	1 19 0	1 17 9
23	1 19 3	1 19 3	1 18 4	2 0 1	1 19 9	1 18 10
24	2 0 1	2 0 1	1 19 2	2 1 3	2 0 7	1 19 10
25	2 1 1	2 1 1	2 0 1	2 2 6	2 1 5	2 0 10
26	2 2 0	2 2 0	2 1 3	2 3 9	2 2 4	2 1 10
27	2 3 0	2 3 0	2 2 7	2 5 2	2 3 4	2 2 10
28	2 4 1	2 4 1	2 3 11	2 6 7	2 4 4	2 3 10
29	2 5 2	2 5 2	2 5 2	2 7 11	2 5 4	2 4 11
30	2 6 3	2 6 3	2 6 4	2 9 2	2 6 6	2 6 1
31	2 7 3	2 7 3	2 7 7	2 10 6	2 7 8	2 7 3
32	2 8 5	2 8 5	2 8 10	2 11 10	2 8 10	2 8 5
33	2 9 7	2 9 7	2 10 3	2 13 4	2 10 2	2 9 9
34	2 10 11	2 10 11	2 11 9	2 14 11	2 11 5	2 11 1
35	2 12 3	2 12 3	2 13 5	2 16 8	2 12 10	2 12 5
36	2 13 8	2 13 8	2 15 1	2 18 5	2 14 3	2 13 10
37	2 15 1	2 15 1	2 16 10	3 0 4	2 15 9	2 15 4
38	2 16 11	2 16 11	2 18 9	3 2 4	2 17 4	2 16 11
39	2 18 9	2 18 9	3 0 6	3 4 5	2 19 1	2 18 6
40	3 0 9	3 0 9	3 2 8	3 6 6	3 0 9	3 0 2
41	3 2 7	3 2 9	3 5 2	3 8 7	3 2 7	3 1 11
42	3 4 6	3 4 9	3 7 8	3 10 9	3 4 6	3 3 9
43	3 6 5	3 6 11	3 10 4	3 12 11	3 6 6	3 5 8
44	3 8 5	3 9 2	3 13 1	3 15 3	3 8 6	3 7 8
45	3 10 8	3 11 6	3 16 1	3 17 8	3 10 9	3 9 8
46	3 12 10	3 14 3	3 18 8	4 0 5	3 13 0	3 11 10
47	3 15 3	3 17 6	4 1 6	4 3 3	3 15 4	3 14 1
48	3 17 10	4 0 8	4 4 8	4 6 6	3 18 0	3 16 6
49	4 0 6	4 4 0	4 8 2	4 10 2	4 0 9	3 19 0
50	4 3 3	4 7 7	4 12 2	4 14 2	4 3 7	4 1 7
51	4 6 1	4 11 2	4 16 7	4 18 9	4 6 5	4 4 3
52	4 9 1	4 15 1	5 1 3	5 3 6	4 9 6	4 8 1
53	4 12 3	4 18 6	5 6 4	5 8 7	4 12 8	4 12 2
54	4 15 7	5 1 11	5 11 7	5 14 1	4 16 0	4 16 5
55	4 19 1	5 5 9	6 17 4	5 19 11	4 19 7	5 0 11
56	5 2 11	5 9 6	6 3 7	6 6 4	5 3 4	5 5 9
57	5 7 0	5 13 6	6 10 4	6 13 2	5 7 3	5 10 9
58	5 11 3	5 17 8	6 17 5	7 0 5	5 11 8	5 16 1
59	5 15 10	6 2 0	7 4 6	7 7 9	5 16 3	6 1 9
60	6 0 9	6 6 7	7 11 7	7 14 11	6 1 1	6 7 10

Participating Offices.

Age.	Asylum.	Caledonian.	Crown.	Eagle. Male.	Eagle. Female.	Economic.	Edinburgh Life.	European.	Guardian.	Palladium.	Scottish Union.	Standard.	University.
	L. s. d.	L. s. d.	L. s. d.	L. s. d.	L. s. d.	L. s. d.	L. s. d.	L. s. d.	L. s. d.	L. s. d.	L. s. d.	L. s. d.	L. s. d.
15	1 6 10	1 16 5	1 15 9	1 17 6	1 12 0	1 10 8	1 16 7	1 14 5	1 16 2	1 18 7	1 12 11	1 16 0	1 16 8
16	1 7 6	1 17 6	1 16 7	1 18 8	1 12 8	1 11 5	1 19 8	1 15 4	1 17 2	1 19 8	1 13 11	1 17 1	1 17 9
17	1 8 3	1 18 6	1 17 5	1 19 9	1 13 4	1 12 3	2 0 8	1 16 2	1 18 2	2 0 8	1 15 0	1 18 2	1 18 8
18	1 9 0	1 19 7	1 18 3	2 0 9	1 13 11	1 13 0	2 1 8	1 17 1	1 19 2	2 1 8	1 16 1	1 19 2	1 19 7
19	1 9 9	2 0 7	1 19 1	2 1 8	1 14 7	1 13 10	2 2 8	1 18 1	2 0 1	2 2 8	1 17 3	2 0 2	2 0 7
20	1 10 7	2 1 6	1 19 11	2 2 6	1 15 1	1 14 7	2 3 7	1 19 0	2 1 0	2 3 7	1 18 5	2 1 1	2 1 5
21	1 11 5	2 2 5	2 0 10	2 3 4	1 15 10	1 15 5	2 4 6	1 19 11	2 1 10	2 4 6	1 19 7	2 1 11	2 2 4
22	1 12 3	2 3 3	2 1 9	2 3 10	1 16 6	1 16 3	2 5 4	2 0 10	2 2 8	2 5 4	2 0 9	2 2 9	2 3 1
23	1 13 2	2 4 1	2 2 9	2 4 4	1 17 3	1 17 2	2 6 3	2 1 10	2 3 6	2 6 3	2 1 11	2 3 7	2 4 0
24	1 14 1	2 4 11	2 3 9	2 4 10	1 18 0	1 18 1	2 7 1	2 2 9	2 4 5	2 7 1	2 3 1	2 4 6	2 4 9
25	1 15 1	2 5 10	2 4 10	2 5 6	1 18 9	1 19 0	2 8 1	2 3 9	2 5 4	2 8 1	2 4 3	2 5 4	2 5 9
26	1 16 1	2 6 10	2 5 10	2 6 2	1 19 7	2 0 0	2 9 1	2 4 10	2 6 4	2 9 1	2 5 4	2 6 5	2 6 8
27	1 17 1	2 7 10	2 6 11	2 7 0	2 0 5	2 1 0	2 10 1	2 5 10	2 7 4	2 10 1	2 6 5	2 7 4	2 7 7
28	1 18 2	2 8 11	2 8 1	2 7 10	2 1 4	2 2 0	2 11 1	2 6 11	2 8 4	2 11 1	2 7 7	2 8 5	2 8 7
29	1 19 3	2 10 0	2 9 2	2 8 10	2 2 3	2 3 1	2 12 3	2 8 1	2 9 6	2 12 3	2 8 9	2 9 5	2 9 8
30	2 0 5	2 11 1	2 10 4	2 9 10	2 3 2	2 4 3	2 13 5	2 9 3	2 10 7	2 13 5	2 9 11	2 10 7	2 10 9
31	2 1 7	2 12 3	2 11 6	2 10 11	2 4 2	2 5 5	2 14 7	2 10 6	2 11 10	2 14 7	2 11 2	2 11 9	2 11 11
32	2 2 10	2 13 6	2 12 9	2 12 0	2 5 3	2 6 8	2 15 9	2 11 10	2 13 0	2 15 9	2 12 6	2 12 11	2 13 0
33	2 4 2	2 14 9	2 14 0	2 13 3	2 6 4	2 8 0	2 17 1	2 13 2	2 14 4	2 17 1	2 13 10	2 14 2	2 14 3
34	2 5 7	2 16 1	2 15 4	2 14 7	2 7 5	2 9 5	2 18 5	2 14 7	2 15 8	2 18 5	2 15 3	2 15 6	2 15 6
35	2 7 1	2 17 6	2 16 9	2 16 0	2 8 7	2 10 11	2 19 10	2 16 0	2 17 0	2 19 10	2 16 9	2 16 11	2 16 11
36	2 8 8	2 19 0	2 18 2	2 17 6	2 9 9	2 12 6	3 1 4	2 17 6	2 18 6	3 1 4	2 18 3	2 18 4	2 18 4
37	2 10 4	3 0 6	2 19 10	2 19 1	2 11 0	2 14 2	3 2 10	2 19 1	3 0 0	3 2 10	2 19 10	2 19 10	2 19 9
38	2 12 1	3 2 3	3 1 2	3 0 9	2 12 3	2 15 11	3 4 6	3 0 9	3 1 7	3 4 6	3 1 6	3 1 6	3 1 4
39	2 13 11	3 3 9	3 2 10	3 2 6	2 13 7	2 17 9	3 6 2	3 2 6	3 3 3	3 6 2	3 3 3	3 3 2	3 2 11
40	2 15 10	3 5 6	3 4 7	3 4 4	2 15 0	2 19 9	3 7 11	3 4 3	3 5 0	3 7 11	3 5 0	3 4 11	3 4 7
41	2 17 10	3 7 5	3 6 5	3 6 3	2 16 6	3 1 10	3 9 9	3 6 3	3 6 9	3 9 9	3 6 10	3 6 9	3 6 4
42	2 19 11	3 9 3	3 8 4	3 8 4	2 18 0	3 4 1	3 11 8	3 8 3	3 8 8	3 11 8	3 8 9	3 8 7	3 8 1
43	3 2 1	3 11 3	3 10 6	3 10 8	2 19 9	3 6 6	3 13 8	3 10 5	3 10 8	3 13 8	3 10 10	3 10 7	3 10 0
44	3 4 4	3 13 4	3 12 8	3 13 0	3 1 6	3 9 0	3 15 9	3 12 7	3 12 8	3 15 9	3 12 11	3 12 7	3 12 0
45	3 6 10	3 15 6	3 15 0	3 15 8	3 3 4	3 11 9	3 17 11	3 15 0	3 14 11	3 17 11	3 15 1	3 14 9	3 14 1
46	3 9 7	3 17 9	3 17 6	3 18 6	3 5 5	3 14 7	4 1 8	3 17 5	3 17 3	4 0 2	3 17 5	3 17 1	3 16 2
47	3 12 7	4 0 3	4 0 1	4 1 7	3 7 7	3 17 8	4 5 3	4 0 0	3 19 8	4 2 7	3 19 10	3 19 7	3 18 6
48	3 16 1	4 2 9	4 2 11	4 5 0	3 9 10	4 0 11	4 8 4	4 2 8	4 2 4	4 5 1	4 2 4	4 2 2	4 1 4
49	3 19 10	4 5 6	4 5 10	4 8 7	3 12 4	4 4 4	4 11 6	4 5 6	4 5 1	4 7 10	4 5 0	4 4 11	4 4 4
50	4 3 10	4 8 4	4 8 11	4 12 4	3 15 0	4 8 0	4 14 8	4 8 6	4 8 0	4 10 8	4 7 9	4 7 10	4 7 6
51	4 8 0	4 11 2	4 12 1	4 16 4	3 17 9	4 11 11	4 18 0	4 11 7	4 11 0	4 13 6		4 10 8	4 10 9
52	4 12 4	4 14 2	4 15 3	5 0 5	4 1 0	4 16 1	5 1 6	4 15 0	4 14 2	4 16 5		4 13 9	4 14 1
53	4 16 10	4 17 4	4 18 6	5 4 8	4 4 4	5 0 6	5 5 1	4 18 7	4 17 5	4 19 7		4 16 11	4 17 8
54	5 1 7	5 0 8	5 1 11	5 8 11	4 7 11	5 5 3	5 8 9	5 2 6	5 0 11	5 2 10		5 0 3	5 1 4
55	5 6 5	5 4 2	5 5 7	5 13 0	4 11 8	5 10 3	5 12 9	5 6 8	5 4 8	5 6 4		5 3 10	5 5 4
56	5 11 5	5 7 11	5 9 6	5 17 10	4 15 9	5 15 7	5 16 9	5 11 2	5 8 7	5 10 1		5 7 9	5 9 7
57	5 16 7	5 11 11	5 13 6	6 2 10	5 0 0	6 1 3	6 1 0	5 15 8	5 12 10	5 14 0		5 11 8	5 14 0
58	6 1 11	5 16 1	5 18 0	6 7 10	5 4 6	6 7 4	6 5 5	6 0 7	5 17 4	5 18 2		5 16 0	5 18 2
60	6 13 0	6 5 4	6 7 2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		6 0 7	6 2 8

Many of the offices have tables calculated for special purposes; so that, in one or other of them, any individual wishing to effect an assurance is certain of having it done in the way he desires. For instance, the Pelican, amongst others, has a table of "Limited Payments," by which persons desirous of paying an annual premium for a limited number of years, instead of one to continue annually during life, may do so on the following terms.

Age.	Payable for Five Years.	Payable for Seven Years.	Payable for Ten Years.	Payable for Fifteen Years.
15	£6 19 4	£5 4 0	£3 17 8	£2 17 6
16	7 2 2	5 6 1	3 19 3	2 18 8
17	7 4 10	5 8 1	4 0 9	2 19 9
18	7 7 6	5 10 1	4 2 3	3 1 0
19	7 10 3	5 12 2	4 3 9	3 2 2
20	7 13 2	5 14 4	4 5 5	3 3 5
21	7 15 0	5 15 8	4 6 6	3 4 3
22	7 17 0	5 17 3	4 7 8	3 5 2
23	7 19 1	5 18 10	4 9 0	3 6 2
24	8 1 4	6 0 7	4 10 3	3 7 2
25	8 3 8	6 2 5	4 11 8	3 8 3
26	8 7 4	6 5 2	4 13 10	3 9 11
27	8 11 3	6 8 2	4 16 1	3 11 8
28	8 15 3	6 11 2	4 18 4	3 13 4
29	8 18 11	6 13 11	5 0 6	3 15 0
30	9 2 2	6 16 5	5 2 4	3 16 5
31	9 5 6	6 18 10	5 4 2	3 17 11
32	9 8 11	7 1 5	5 6 2	3 19 6
33	9 12 6	7 4 2	5 8 4	4 1 1
34	9 16 5	7 7 2	5 10 7	4 2 11
35	10 0 6	7 10 3	5 13 1	4 4 10
36	10 4 9	7 13 7	5 15 8	4 6 9
37	10 9 3	7 17 0	5 18 4	4 8 10
38	10 13 10	8 0 7	6 1 0	4 10 11
39	10 18 8	8 4 4	6 3 11	4 13 1
40	11 3 6	8 7 11	6 6 8	4 15 2
41	11 9 9	8 12 8	6 10 3	4 17 10
42	11 15 11	8 17 4	6 13 9	5 0 6
43	12 2 2	9 2 0	6 17 3	5 3 2
44	12 8 6	9 6 10	7 0 10	5 6 0
45	12 15 1	9 11 8	7 4 6	5 8 11
46	13 0 0	9 15 4	7 7 4	5 11 3
47	13 5 2	9 19 3	7 10 5	5 13 10
48	13 10 8	10 3 6	7 13 9	5 16 9
49	13 16 11	10 8 3	7 17 6	6 0 1
50	14 3 10	10 13 7	8 1 10	6 3 10

The following are the premiums required by the Pelican for assurances on joint lives and survivorships.

Assurances on Joint Lives.

Ages of the Parties not exceeding		Annual Premium.
10	10	£2 6 5
	15	2 9 11
	20	2 13 4
	25	2 18 0
	30	3 3 10
	35	3 10 4
	40	3 19 4
	45	4 9 5
	50	5 4 10
	55	6 9 6
	60	8 3 4
15	15	2 13 3
	20	2 16 6
	25	3 1 1
	30	3 6 9
	35	3 13 1
	40	4 2 1
	45	4 12 0
	50	5 7 3
	55	6 12 0
	60	8 5 10
20	20	2 19 7
	25	3 3 11
	30	3 9 5
	35	3 15 7
	40	4 4 1
	45	4 14 0
	50	5 9 1
	55	6 13 9
	60	8 7 5
25	25	3 8 0
	30	3 13 3
	35	3 19 2
	40	4 7 6
	45	4 17 1
	50	5 12 1
	55	6 16 6
	60	8 10 2

Ages of the Parties not exceeding		Annual Premium.
30	30	£3 18 1
	35	4 3 8
	40	4 11 9
	45	5 1 0
	50	5 15 8
	55	7 0 0
	60	8 13 8
35	35	4 8 9
	40	4 16 4
	45	5 5 1
	50	5 19 8
	55	7 3 3
	60	8 16 8
40	40	5 3 4
	45	5 11 4
	50	6 5 0
	55	7 8 0
	60	9 1 5
45	45	5 18 5
	50	6 11 0
	55	7 13 6
	60	9 5 6
50	50	7 2 5
	55	8 3 9
	60	9 14 8
55	55	9 4 1
	60	10 0 2
60	60	12 3 6

Survivorship Assurance.

Age of A, the Life to be assured.	Age of B, the Life against which the Assurance is to be made.	Annual Premium.	Age of A, the Life to be Assured.	Age of B, the Life against which the Assurance is to be made.	Annual Premium.	Age of A, the Life to be assured.	Age of B, the Life against which the Assurance is to be made.	Annual Premium.
10	10	£1 3 3	30	10	£2 1 6	50	10	£4 5 4
	20	1 4 1		20	2 1 2		20	4 5 8
	30	1 2 4		30	1 19 2		30	4 1 5
	40	1 1 0		40	1 17 7		40	3 19 11
	50	0 19 7		50	1 14 6		50	3 11 2
	60	0 18 0		60	1 11 6		60	3 0 0
	70	0 16 7		70	1 9 1		70	2 10 1
	80	0 15 3		80	1 6 9		80	2 2 9
20	10	1 9 3	40	10	2 18 4	60	10	7 5 4
	20	1 9 10		20	2 18 2		20	7 5 2
	30	1 8 3		30	2 14 2		30	7 2 1
	40	1 6 1		40	2 11 8		40	7 1 10
	50	1 4 2		50	2 5 1		50	6 14 8
	60	1 2 4		60	1 19 7		60	6 1 9
	70	1 0 3		70	1 15 6		70	5 6 2
	80	0 19 2		80	1 12 9		80	4 12 1

Life Assurance.

Endowments for children attaining the age of fourteen or twenty-one, may also be made by the payment of a specific sum, or by an annual rate, as follows.

(14.)

Age.	One Payment.	Annual Payment.
1 Year	£57 16 11	£5 14 6
2 Years	60 14 4	6 7 0

(21.)

Age.	One Payment.	Annual Payment.
1 Year	£43 1 11	£3 2 11
2 Years	45 4 9	3 7 11
3	47 7 11	3 13 5
4	49 11 11	3 19 6
5	51 17 7	4 6 6
6	54 3 10	4 14 4
7	56 10 9	5 3 4
8	58 18 2	5 13 9
9	61 6 5	6 5 11
10	63 15 6	7 0 4

The advantage to a person assuring in any one office as compared with another, must plainly depend on a comparison between the premiums demanded, the conditions of the policy, and, above all, the security which it holds out. Where it is wished to assure on a certain life for a limited period, the party having no interest in procuring a larger sum, in case of death, than the amount assured, makes his application to that office where he can get it effected at the lowest premium. Such an office will be a Proprietary one. The principal advantage of such companies is, that individuals dealing with them know exactly what they are about. They know the precise premium they will have to pay, and the exact amount of the sums that will accrue to their assignees at their decease. The subscribed capital of such associations as the Pelican, Sun, Royal Exchange, &c. and the wealth of their partners, afford unquestionable security; and, unless some very unprecedented and unlooked-for change in the condition of the country take place, they may reckon with certainty on the terms of the policy being fulfilled to the letter. If, on the other hand, the individual be desirous of leaving as large an amount as he can afford to assure to his family, and more especially if he happen to be a young and a healthy life, he will generally prefer the conditions of a Participating or a Mutual Assurance society. The subscribed capital and fortunes of the former of these afford a guarantee on which the public may depend, in dealing with any respectable society of this sort; whilst, by receiving a share of the profits, the assured gain by the flourishing condition of the association, and it is of less consequence to them though the premium should be too high.

The *whole* profits of Mutual Assurance societies being divided amongst the assured, render such establishments of very great value, particularly to young lives; instances having frequently occurred of more than double the amount assured on one life being paid at the termination of a long standing policy in one of these societies. It has been objected to them, that every one being a partner of the concern, has not only his own life assured, but is part assurer of the lives of all the other members, and may, in this capacity, incur some serious responsibilities; but in this there is a material mistake, since it is a stipulation in the contract of copartnery of every such society, that the funds of the society alone shall be liable for their losses; and thus, though there may be a distant possibility of the sums assured not being paid in full, it is directly undertaken by every individual entering the society, that no claim shall be made on his account upon any of the other members. Moreover, when it is considered that the premiums required by all the assurance companies are very much higher than the risk demands, and that those of Mutual Assurance societies are among the highest, there is little danger, when due precaution is taken in accepting lives, of any loss being incurred by partaking of the benefits of this description of society. This will be placed in a still clearer view by the perusal of the following table from Mr Babbage's work on life assurance, exhibiting the profit per cent. on the premiums of several English offices, on an assurance on a life aged forty-six, which is about one year less than the average age of persons assuring.

Alliance	30·2
Amicable	25·5
British Commercial	16·6
Crown	25·5
Economic	16·2
Equitable	29·8
European	21·5
Guardian	25·1
London Assurance	26·7
Medico-Clerical	29·7
Norwich Union	19·3
Sun	30·9
United Empire	21·9
University	23·2
West of England	16·9

The most important points to be attended to in this description of insurance are the following.

1. No life assurance can be effected without an interest in the life. This was enacted to prevent gambling transactions, by stat. 14 Geo. III. c. 48, sect. 1, which declares that " no insurance shall be made by any person or persons, bodies politic or corporate, on the life or lives of any person or persons, or any other event or events whatsoever, where the person or persons for whose use or benefit, or on whose account, such policy or policies shall be made, *shall have no interest*, or by way of gaining or wagering; and that every insurance made contrary to the true intent and meaning of this act shall be null and void to all intents and purposes whatsoever." Under this act it has been found, that though a *bona fide* creditor has a sufficient interest in the life of his debtor to enable him to effect a valid assurance on such life; still, that in the case of money won at play, the creditor has not an assurable interest in the life of the individual who lost the money to him.

2. Life assurances are always assignable; indeed were they otherwise, assurance on lives would lose much of its utility. It is an every-day occurrence for a debtor to open a policy on his own life, and to assign it in security; and there can be no ground for pleading the extinction of the policy on his payment of the debt; for the benefit of the assurance still belongs to him, and he may make it the means of credit on another occasion, or dispose of it by settlement or otherwise. Assignment in sequestration carries a policy of life assurance; and if the debtor has secretly disposed of it after his bankruptcy, the person to whom it has been assigned will be bound to return any money drawn under it as for the use of the creditors. In the case of Schondler *v.* Wace, the bankrupt held a policy upon his own life, which, after bankruptcy, he sold to Wace for a lottery ticket. He died, and Wace received the sum assured. The assignees under the commission brought an action for recovery, and it was found that this

was a possibility of benefit to which they were entitled, as part of the bankrupt's effects; the defendant having a right, however, to deduct his outlay.

3. As the conditions in fire insurance form part of the contract; so, in life assurance, the declaration made previously to the policy being extended, is considered as part and parcel thereof. In this declaration it is stated that he whose life is to be assured "has no disorder tending to the shortening of life;" but this does not imply that he is free from all complaints, provided he be in a reasonably good state of health. Nor does it appear to be sufficient evidence of the tendency of the disorder to shorten life, that the person had it at a former period, and afterwards died of it, if free from disease at the time of assuring.

4. The death must happen within a limited time, otherwise the assurers are not liable; and there is no doubt, if an individual whose life is assured for one year be fatally wounded during the existence of that policy, but linger till after the term limited in the contract, that his executors have no claim. When, however, an assurance of this description exists on a man's life who goes to sea, and the vessel in which he sailed is never afterwards heard of, a question arises for a jury to decide from the circumstances produced in evidence.

5. In almost every life policy there are several exceptions in limitation of the risk. These generally are, death abroad or at sea; entering into naval or military service without the previous consent of the company; death by suicide; death by the hand of justice; and, in some offices, also death by duelling. The three last, however, do not apply where the assurance is effected on the life of another.

6. The premium on life assurance is not returnable. If a person whose life was assured should commit suicide or be put to death by the hand of the executioner the next day after the risk commenced, there would be no return of premium.

7. Life assurances, when a loss happens upon them, must be paid according to the tenor of the agreement, in the full sum assured, as this sort of policy, from its nature, being on the life or death of man, does not admit of the distinction between total and partial losses.

III.—MARINE INSURANCE.

Most persons are in some degree acquainted with fire and life insurances; the security which they afford to individuals and families is a comfort which no one is willing to dispense withal. Hence the great increase in modern times of companies professing to afford this security; and hence the knowledge on the part of the public generally, of the nature and principles of the engagements into which these companies enter. But marine insurance is a subject of immediate interest only to merchants and ship-owners; and in times of peace it is, even to them, of a much less engrossing nature than during the bustle and excitement of a Continental or an American war.

It is used as a means of indemnification for loss or damage to ships or goods whilst at sea, and that arising either from the elements or the enemy. From its nature there is no doubt of its being of a much more ancient date than either of the preceding, its introduction having generally been attributed to the Lombards and Venetians, the great carrying traders of Europe during the thirteenth, fourteenth, and fifteenth centuries. On the Continent it has consequently been longer practised, and is there much better understood than either fire or life insurance. The famous *Ordonnance de la Marine* of Louis XIV. was published in 1681, and has ever since been a standard work on this subject. In England there are few positive enactments to regulate marine insurance, its practice having been conformed to general principles and the usage of trade. The endless variety of circumstances connected with it naturally render it a much more abstruse and difficult subject than any other kind of insurance; and the numerous points, as sea-worthiness, deviation, capture, and others, which must be attended to, have from time to time created a vast variety of most complex and difficult cases in our law courts. Upon these the laws of British marine insurance are founded.

The nature of this contract is similar to those of the other descriptions of insurance. Suppose it has been remarked, that of fifty ships of the ordinary degree of sea-worthiness, employed in a given trade, one is on an average annually cast away; the probability of loss will plainly be equal to one fiftieth: and if an individual wish to insure a ship, or the cargo on board a ship, engaged in this trade, he ought to pay a premium equal to the one fiftieth part of the sum he insures, exclusively of such an additional sum as may be required to indemnify the insurer for his trouble, and to leave him a fair profit. If the premium exceed this sum, the insurer is overpaid; if it fall below it, he is underpaid. In this country marine insurance has always been for the most part effected with individuals; and of these the subscribers to Lloyd's have, from the extent of their transactions, been long the most distinguished. When a merchant or ship-owner desires to effect an insurance, he fills up a blank policy, so as to meet the particular object in view; he then hands it to one of the members of the room, who either rejects it, or underwrites for a certain limited sum; from him it goes to another; and thus it is handed about until the amount required is complete. Agents are appointed in all the principal parts of the world, who forward regularly to Lloyd's, accounts of all the arrivals at, and departures from, their ports, as well as of losses and other casualties, and, in general, all such information as may be supposed of importance towards guiding the judgments of the underwriters. In addition to this, there are annually published certain register books for shipping, which give an account of the tonnage, build, age, repairs, and quality of almost all the vessels that frequent our ports; and which, though in many respects defective, are material assistants to the insurers. Besides the subscribers to Lloyd's, there are many wealthy individuals, both in London and in all the considerable sea-ports of the kingdom, who underwrite policies of marine insurance. As these cannot be personally known to many of the ship-owners, a set of middle-men, or brokers, have arisen, whose business it is to receive orders for insurance, who apply to the persons they suppose most likely to cover the risks; and also become responsible for them being effected with accuracy and celerity.

Many of the inconveniences attending this mode of effecting insurance, particularly in the saving of time, are obviated when the business is transacted with a company. In such a case, the party having property to insure goes directly to the manager of the company, and states the particulars of the risk to be insured; when the premium is agreed on, the manager writes out a memorandum of the policy, which the party signs, and he is thus effectually insured before he leaves the office. The security afforded by such companies is also of infinite importance to the insured; severe and heavy losses having frequently occurred, from the bankruptcy or inability of individual underwriters. The Royal Exchange, Alliance Marine, Indemnity Mutual Marine, and London Assurance, are the principal companies for marine insurance in the metropolis; and, as well as the private underwriters mentioned above, there are similar establishments, though on a smaller scale, in most of the large sea-ports of the empire.

With respect to the rates of premium charged for marine insurance, it is self-evident that these will vary ac-

Marine Insurance.

cording to the seasons, the quality of the vessel, the known character of the captain, the nature of the commodity, and the state of our political relations. Of these no comprehensive table could be constructed, and therefore they come naturally to be regulated very much by general experience and particular information. All policies of marine insurance must be on stamped paper, the duties on which are as follows, viz.

On coasting voyages,	when the premium does not exceed twenty shillings per cent.	L.0 1 3
Ditto,	when the premium is above twenty shillings per cent.	0 2 6
On foreign voyages,	when the premium does not exceed fifteen shillings per cent.	0 1 3
Ditto,	when the premium does not exceed thirty shillings per cent.	0 2 6
Ditto,	when the premium is above thirty shillings per cent.	0 5 0

When reckoned by time, two shillings and sixpence per cent. is charged when under three months, and five shillings when the voyage exceeds that period.

It would be quite foreign to the purpose of the present work were we to enter upon the legal details of marine insurance. On this point the standard English authors, Park and Marshall, and the work of the learned professor of Scotch Law, Mr Bell, afford every possible information. We shall merely take notice of the following circumstances to be attended to in the contract.

1. The name of the insured or his agent is required by statute. By 28 Geo. III. c. 65, it is enacted, that it shall not be lawful for any person or persons to make or effect, or cause to be made or effected, any policy of insurance upon any ship, without first inserting, or causing to be inserted, in such policy or policies of insurance, the name or names, or the usual style and firm of dealing, of one or more of the persons interested in each insurance. This was required to remedy the evil of policies being issued in which the name of the insured was purposely left blank.

2. The names of the ship and master are necessary to identify the subject-matter of the policy; for whether it be ship, or freight, or goods, the risk attaches itself to a particular bottom. The place and time at which the risk is to commence and terminate are obviously requisite particulars; but the subject of the insurance is the essential part or *sine qua non* of the contract, for there must be no room to question what property is really put in risk.

3. The policy must be subscribed or underwritten with the names of the several insurers, each adding to his name the sum for which he is liable; and this may be done by a procurator acting under either express or tacit delegation. No witnesses are required.

4. The insured are under certain obligations in respect to representation and warranty of the facts whereon the undertaking of indemnity is grounded. Insurance being a contract of faith, in which the insurer is to rely for the most part on the statement of the insured, his representation of the facts must be fair and open; there must be no misrepresentation, no false insinuation, no concealment of circumstances material to the risk. Warranty, again, is an absolute condition expressed or implied, relative to the state or circumstances of the subject insured, which, if not true, or not complied with, defeats the insurance, whether material to the risk or not. A warranty may be affirmative, as that a ship was safe on a particular day; or promissory, that the ship will proceed with the convoy, or sail on a day certain; express, as that the ship is to sail on a day certain, or that she was on a certain day safe in harbour; or implied, including all those conditions relative to the risk which necessarily enter into the conception of the contract, as that the ship is seaworthy, that the voyage is lawful, that there shall be no deviation, and so on.

5. Policies are of two kinds, valued and open. By the former, the value of the subject insured is fixed by agreement of the parties, so that when a loss occurs, the value stated in the policy regulates the settlement, without regard to the original cost or invoice of the subject insured. By the latter the value is left open, and in case of loss the assured must adduce evidence of his interest, and he recovers indemnification only to the actual extent of his loss. In the settlement of a loss under an open policy, the ship is valued at what she was worth at the time of sailing, including her stores; the freight, at the amount which she would have earned according to the charter-party; and the cargo, at the invoice price, including the premium of insurance, and all charges.

6. Losses may be said to be of three kinds; total, general average, and partial loss. The former consists not solely in the entire destruction of the subject insured, but in such damage as to render it of little or no value to the owner, or at least to frustrate the adventure the securing of which was the object of the insurance.

When the total loss is manifest and undoubted, as where a ship is lost and is never heard of again, it falls directly upon the underwriter; but where any thing remains, the claim for loss must be accompanied by abandonment, which is a renunciation to the underwriter of all right, title, and claim to what may be saved, leaving it to him to make the most of it for his own benefit. In abandoning, the insured must make up his mind *tempestive;* but he is not bound to do so till he has an opportunity of receiving correct information. The common custom now-a-days, in paying such losses, is for the underwriter to settle for a certain per-centage, retaining a sum equivalent to the probable proceeds, leaving the insured to recover the savings, and settling the balance of the loss when these are ascertained.

General average is constituted by the voluntary sacrifice of the ship's materials, or part of the cargo, or when charges are incurred for the general benefit, such as the cutting from anchors and cables to avoid a lee shore, jetson of part of the cargo to lighten the vessel, expenses of taking the ship off the strand, &c.; in which, and all similar cases, the loss and expenses are borne by ship, cargo, and freight, in proportion to their respective values saved.

Partial loss, or, as it is in general termed, *particular average*, means a loss or damage by unavoidable accidents, not amounting to a total loss. Under it is included damage to the ship by stranding, by unavoidable collision with another vessel, damage to the hull, boats, masts, or other parts, by a stroke of the sea, by lightning, accidental fire, &c. These, and such like, are of the nature of particular average on the ship; but the springing of a leak at sea, or the splitting of sails, or the parting of a cable, and similar damages, are held to be the ordinary wear and tear of the ship, and which the owner cannot recover from the underwriter.

Particular average on the cargo means damage by sea-water, fire, or any accident which the care of the master and crew could not prevent. (See article AVERAGE.)

7. The mode of settlement after the damage is ascertained is likewise an important subject.

In adjusting a partial loss on a ship, it is usual to deduct one third from the new materials and labour, except on certain articles, unless the ship or the materials injured were perfectly new. When the loss is on cargo, it is settled either by taking the invoice price and deducting the nett proceeds of sale of the damaged goods, or by comparing the amount of sales of the damaged goods with a *pro forma* account of sales of the same articles if they had arrived in a sound state. The former of these, termed a *salvage* loss, is the mode of adjustment where the goods required to be sold short of the port of destination, and where it was consequently impossible to refer to the market price of that port, as in the second instance. The latter method avoids involving the underwriters in a falling or rising market; the market price of the sound and of the damaged commodities being said to be the scales in which to weigh the depreciation.

INTAGLIOS, precious stones, on which are engraved the heads of great men, inscriptions, and the like; such as we frequently see set on rings, seals, and other ornamental articles.

INTEGER, in *Arithmetic*, a whole number, in contradistinction to a fraction.

INTEGRAL, or INTEGRANT, in *Philosophy*, appellations given to parts of bodies which are of a similar nature with the whole. Thus filings of iron have the same nature and properties as bars of iron.

Bodies may be reduced into their integrant parts by triture or grinding, limation or filing, solution, amalgamation, and other processes.

INTEGRAL *Calculus*, in the new analysis, is the reverse of the differential calculus, and is the finding of the integral from a given differential, being similar to the inverse method of fluxions. See FLUXIONS.

INTELLECT, a term used amongst philosophers to signify that faculty of the soul usually called the *understanding*. See LOGIC and METAPHYSICS.

INTENDANT, one who has the conduct, inspection, and management of any thing.

INTENDMENT, in *Law*, is the intention, design, or true meaning, of a person or thing, which frequently supplies what is not fully expressed; but though the intention of parties in deeds and contracts is much regarded by the law, yet it cannot take place against the rules of law.

INTENDMENT *of Crimes*. This, in case of treason, where the intention is proved by circumstances, is punishable in the same manner as if it had actually been put in execution.

INTENT, in the civil law, signifies to begin or commence an action or process.

INTENTION, in *Physics*, the increase of the power or energy of any quality, as heat or cold, by which it stands opposed to *remission*, which signifies its decrease or diminution.

INTENTION, in *Metaphysics*, denotes an exertion of the intellectual faculties with more than ordinary vigour, when the mind earnestly fixes its view on any idea, considers it on all sides, and cannot be called off by any solicitation.

INTERCALARY, an appellation given to the odd day inserted in leap-year; which was so called from *calo, calare*, to proclaim, it being proclaimed with a loud voice by the priests.

INTERCESSION (*intercessio*) was used in ancient Rome for the act of a tribune of the people, or other magistrate, by which he inhibited the acts of other magistrates; and even, in the case of the tribunes, the decrees of the senate. *Veto* was the solemn word used by the tribunes when they inhibited any decree of the senate, or law proposed to the people. The general principle of these intercessions was, that any magistrate might inhibit the acts of his equal or inferior; but the tribunes had the sole prerogative of controlling the acts of every other magistrate, yet could not themselves be controlled by any.

INTERCESSOR (from *inter* and *cedo*, I go between), a person who prays, expostulates, or intercedes, in behalf of another. In the Roman law, intercessor was the name of an officer, whom the governors of provinces appointed principally to raise taxes and other duties.

INTERCESSOR is also a term which was heretofore applied to such bishops as, during the vacancy of a see, administered the bishopric till a successor to the deceased prelate had been elected. The third council of Carthage calls these *interventors*.

INTERCOLUMNIATION, in *Architecture*, denotes the space between two columns, which is always proportioned to the height and bulk of the columns.

INTERCOSTAL, in *Anatomy*, an appellation given to such muscles, nerves, arteries, and veins, as lie between the ribs.

INTERDICT, an ecclesiastical censure, by which the church of Rome forbids the performance of divine service in a kingdom, province, or town. This censure has frequently been enforced in France, Italy, and Germany; and, in the year 1170, Pope Alexander III. put all England under an interdict, forbidding the clergy to perform any part of divine service, except baptizing infants, taking confessions, and giving absolution to dying penitents. But this censure being liable to the evil consequences of promoting libertinism and a neglect of religion, the succeeding popes have very seldom had recourse to it.

There was also an interdict of persons, who were deprived of the benefit of attending at divine service. Particular persons were also anciently interdicted the use of fire and water, which signified a banishment for some particular offence. By this census no person was permitted to receive them, or allow them the use of fire or water; and being thus wholly deprived of the two necessary elements of life, they were doubtless under a sentence of proscription.

INTEREST

Is the sum which the borrower of a *capital* obliges himself to pay to the lender for its *use*.[1]

Formerly it was universally believed that, in the event of all legislative enactments fixing and regulating the rate of interest being repealed, its increase or diminution would depend wholly on the comparative scarcity or abundance of money; or, in other words, that it would rise as money became scarce, and fall as it became more plentiful. Mr Hume was the first to point out the fallacy of this opinion,[2] and to show that the rate of interest is not determined by the amount of the currency, but by *the average rate of profit derived from the employment of capital*. No doubt it most frequently happens that, when a loan is made, it is made in the currency of the country. This, however,

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[1] Interêt: loyer d'un *capital* preté; ou bien, en termes plus exacts, achat des *services productifs* que peut rendre un capital. (Say, tome ii. p. 480, ed. 4me.

[2] See his *Essay on Interest*.

is really of no consequence. There is obviously no difference between one individual furnishing another with 100 bushels of corn, to be repaid at the expiration of a twelvemonth by the delivery of 104 or 105 bushels, or with as much money at four or five per cent. as would have purchased the corn. Besides, it is easy to perceive that the same identical sum of money might serve to negotiate an infinity of loans. Suppose A lends to X L.1000, which X immediately pays away to B for commoditics of equal value; but B has no use for the money, and he therefore lends it to Y, who pays it away for commodities to C, who again lends it to Z, and so on; it is plain the borrowers X, Y, Z, have really received a loan of commodities, or capital, from the lenders A, B, C, worth *three* times (and it might have been worth three hundred or three thousand times) as much as the money employed in settling the transactions. According as the supply of currency, compared with the business it has to perform, is greater or less, we are obliged to give a greater or less number of guineas or livres, pound notes or assignats, for the commodities we wish to obtain. It is plainly, however, by the *advantage* or *profit* we expect to derive from the acquisition of the commodities which constitute capital, and not from the accidental, and, in this respect, unimportant, circumstance of a larger or smaller number of pieces of gold or silver, or of bits of engraved paper, being given for them, that the rate of interest, or the compensation given to the lender for the use of his stock, must be determined. It may perhaps be supposed, that when the quantity of metallic money is increased, goldsmiths, jewellers, &c. obtain the raw material for carrying on their business with greater facility; but this is not always the case, and, though it were, it would not affect the rate of interest. No coins are ever sent to the melting pot unless when the currency is either degraded or depreciated; that is, unless it be deficient in weight, or *relatively* redundant in quantity. And it is clear that the inducement to promise a high or low rate of interest for loans of metallic money, which it was intended to work up into some species of manufactured goods, would depend, not on the supply of such money, but on the profit to be derived from the operation, a circumstance totally unconnected with the scarcity or abundance of coin.

It appears, therefore, that the rate of interest, at any given period, depends exclusively on the supply of real disposable capital, such as land, machinery, raw and manufactured products, &c. compared with the power of profitably employing it. An increase of metallic money adds only very inconsiderably, and an increase of paper money adds nothing whatever, to the real capital of the country, or to the material of which all loans are really composed. If an increase of paper money was equivalent to an increase of capital, bank notes could not be too much multiplied, and France would have been about twenty times as rich at the era of the assignats as at this moment. It is not denied that considerable mischief and derangement must always be experienced in a highly manufacturing and commercial country like Great Britain, when any sudden check is given to the facility with which discounts are generally obtained, or when the currency is suddenly contracted. But the *frottement* and inconvenience occasioned by a contraction of the currency could only be temporary. It is impossible it could have any lasting effect on the industry of the country. We should still possess the same amount of real capital; and as neither its productive power, nor the liberty to transfer it from one individual to another, would be at all impaired, the real revenue of the state would continue as great as ever, and the same or a greater amount of stock might be disposed of by way of loan. *Money prices* would certainly fall proportionally to the reduction of the currency; or, which is the same thing, the value of commodities would henceforth have to be ascertained by comparing them with a smaller number of bits of gold or paper. But, in every other respect, the business of society would continue exactly on its former footing; and, without some change in the rate of profit, on which fluctuations in the value of money have almost no effect, the rate of interest would continue invariable.

Mr Ricardo has set this principle in a clear and striking point of view. "The rate of interest," he observes, in answer to those who had contended that it would be increased by a diminution of the discounts of the Bank of England, "is not regulated by the rate at which the bank will lend, whether it be five, four, or three per cent., but by the rate of profit which can be made by the employment of capital, and which is totally independent of the quantity and of the value of money. Whether a bank lend one million, ten millions, or a hundred millions, they would not permanently alter the market rate of interest; they would alter only the value of the money which they thus issued. In one case ten or twenty times more money might be required to carry on the same business, than what might be required on the other. The applications to the bank for money, then, depend on the comparison between the rate of profits that may be made by the employment of it, and the rate at which they are willing to lend it. If they charge less than the market rate of interest, there is no amount of money which they might not lend; if they charge more than that rate, none but spendthrifts and prodigals would be found to borrow of them. We accordingly find, that when the market rate of interest exceeds the rate of five per cent. at which the bank uniformly lend, the discount office is besieged with applicants for money; and, on the contrary, when the market rate is even temporarily under five per cent., the clerks of that office have no employment."[1]

It is foreign to the object of this article to enter into any detailed examination of the causes which tend to elevate or depress the rate of profit. Whatever diversity of opinion may be entertained respecting them, it is abundantly evident that the rate of interest afforded for the use of borrowed capital must be proportional to the profits which might be derived from its employment. In the United States, the market rate of interest varies from ten to fourteen per cent.; and in Holland, previously to the invasion of the French in 1794, it did not exceed two or three per cent. The immense extent of fertile and uncultivated land in America, the lowness of taxation, and the absence of all restrictive regulations, naturally occasion high profits, and consequently high interest; whilst the sterility and limited extent of the soil of Holland, the excessive load of taxes, laid equally on necessaries and luxuries, and the injudicious restraints imposed upon various branches of commerce, by rendering it impossible to derive large returns from capital, proportionally sink the rate of interest. Had the soil of Holland been as fertile, and taxation as light, as in the United States, profits and interest would, notwithstanding the abundant supply of capital, have been equally high in the one republic as in the other. It is not by the absolute amount of the stock of a country, but by the comparative facilities for its advantageous employment, that the compensation or interest which a borrower can afford for its use must always be regulated. Previously to the termination of the late war, the market rate of interest in this country, for sums which could not be immediately demanded, fluctuated from five to twelve

[1] Ricardo's *Principles of Political Economy*, 1st edit. p. 511.

Interest.

per cent. It has since fallen to four or five per cent.; a decline which has not certainly been occasioned by any sudden increase of capital, but by the extraordinary depression of commerce, and the consequent impossibility of investing stock so as to yield as large a profit as it did during the period when we engrossed almost the whole trade of the world.

Rate of interest varies according to the security for the payment of the principal and duration of the loan.

Besides such variations as are proportional to variations in the general and average rate of profit, and which *equally* affect *all* loans, the rate of interest must vary according *to the degree of security afforded for the repayment of the principal, and the duration of the loan.* No capitalist would lend on the personal security of a gunpowder manufacturer, and on *mortgage* over a valuable estate, at the same rate of interest. The extraordinary hazard of the gunpowder trade exposes the stock invested in it to an extreme degree of *risk.* It may be dissipated in an instant, and the power of the borrower to refund the capital he had borrowed annihilated for ever. A lender of money on mortgage is almost entirely relieved from such contingencies. The owner of an estate on which a loan is secured may become bankrupt; but the estate itself will remain, and may either be sold or taken possession of by the lender. It is plain, therefore, that there must be a very great difference in the rate of interest paid by those whose security for the repayment of the principal is so exceedingly different. The gunpowder manufacturer, besides paying a rate or per-centage equivalent to the common and average rate of interest derived from the most secure investments, would have to pay an *additional* rate, which, although it might not be designated by that name, would really constitute a *premium* of insurance proportioned to the greater risk to which the lender was exposed of losing his principal. The preferable security offered by the landholder would relieve him from the necessity of paying any considerable premium, or excess of interest, on account of risk; and of course he would be able to borrow at so much less than the manufacturer. We should mistake, however, if we supposed that the latter was thus placed in a comparatively disadvantageous situation. He would be completely indemnified for the greater risk to which his stock was exposed, and for the higher rate of interest which he was in consequence obliged to pay, by the greater *gross profits* he would derive from his business. The constantly operating principle of competition will not permit, taking every thing into account, a greater *nett profit* to be permanently derived from one department of industry than from another. But those who invest their stock in employments of more than ordinary hazard, must be able to dispose of their produce at such a price as will yield them the common and average rate of profit, besides affording a surplus adequate to insure their stock against the extra risk to which it is exposed. If this were not the case, no capitalist would place his property in a state of comparative danger, and no undertakings of a hazardous nature would be entered into. Wherever there is risk, that risk must be compensated. And it may, and very frequently does, happen, that the manager of a hazardous branch of industry, paying from ten to twenty per cent. for borrowed capital, is realizing a larger nett profit than the landlord who has purchased an estate with money for which he only pays three or four per cent.[1]

But supposing the securities to be equal, capital lent for *short* periods, or in such a way that the lender may obtain possession of it *at pleasure,* will always bring a lower rate of interest than capital lent for a considerable or definite period. No borrower could afford to pay so high a rate of interest for a capital whose productive services he might be deprived of in an instant, and which he could not therefore venture to invest in any employment from which it might not be easily withdrawn, as for a capital lent for a fixed period, especially if that period was of considerable length. But here, as in every other case, the real interests of the borrower and lender coincide. The same circumstances which prevent a borrower from giving as high a rate of interest for a loan payable on demand as if it were payable at a fixed and distant term, induces the lender to rest satisfied with a smaller compensation in the one case than in the other. We wish to be able to exercise a complete command over our capital. No merchant would ever consent to lend his stock on mortgage. If he did, he would no longer be able to carry on his business with advantage. He would be deprived of all power of speculating; and although this might in many instances be for his advantage, yet the flattering opinion which every one entertains of his own abilities and good fortune would but seldom allow him to doubt of its being a very material disadvantage. It is by this principle that we are able to account for the comparatively low rate of interest at which banking companies who pay the sums deposited with them on demand, and governments whose circumstances are perfectly desperate, are able to borrow. A stockholder's mortgage (his claim on the revenue of the country) can be immediately converted into cash at the current prices. And, however much the majority of the public creditors may be impressed with a conviction of the inability of the state to discharge *all* the claims upon it, every particular individual, confident in his own good fortune, foresight, and acuteness, flatters himself with the idea that *he,* at least, will be able to predict the coming tempest, and that *he* will be able to sell out before a national bankruptcy.

Interference of government in adjusting the rate of interest.

Instead, however, of leaving the rate of interest to be adjusted by the unfettered competition of the borrowers and lenders, on the principles we have thus briefly explained, the governments of most countries have interfered, either to prohibit the taking interest altogether, or to fix certain rates which it was declared legal to exact, at the same time that any excess over these rates was declared to be *usury,* and prohibited under the severest penalties. In the rude and unenlightened ages in which these enactments had their origin, the precious metals, then the only species of money, were considered as uninfluenced by the same principles which regulate the value of other products. Being used both as standards whereby to ascertain the comparative value of different commodities, and as the equivalents for which they were most frequently exchanged, they acquired a factitious importance, not merely in the estimation of the vulgar, but in that of persons of the greatest discernment. The simple consideration that all buying and selling is really nothing more than the bartering of one commodity for another, of a certain quantity of corn or beef, for example, for a certain quantity of gold or silver, and *vice versa,* was entirely overlooked. The attention was gradually trans-

[1] This principle is never lost sight of in bargaining for loans. In Athens, the rate of interest was not regulated by law; and it is distinctly mentioned by ancient authors, that the average rate of interest paid by those who employed their stock in the shipping trade with the countries situated on the Euxine and Mediterranean Seas amounted, on account of the hazard of the voyage, to about thirty per cent.; whilst bankers, agriculturists, and others, whose security was preferable, paid only about twelve per cent. Say, in noticing this striking fact, supposes that the thirty per cent. was charged by the voyage; and that, as two voyages to the Crimea or Sicily might be made annually, *maritime* interest really amounted at Athens to sixty per cent. There does not, however, appear to be the least ground for this assertion. It is the average annual rate of interest that is always spoken of. (*Travels of Anacharsis*, vol. iv. p. 368, Eng. Transl.; De Pauw, *Récherches sur les Grecs*, tom. i. p. 287; Say, tom. ii. p. 132.)

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ferred from the money's worth to the money itself; and the wealth of states and of individuals came to be measured, not by the abundance of their disposable produce, by the quantity or value of the commodities with which they could afford to purchase the precious metals, but by the *quantity of these metals* actually in their possession. Because it sometimes happened that the holders of ordinary commodities were unable easily to dispose of them at any price, whilst money was always sure to find a ready and advantageous market, it was considered as something mysterious, as a real *marchandise par excellence.* We cannot, therefore, be surprised at the measures to which the erroneous opinions entertained respecting it necessarily led; or that efforts should have been made to protect the interests of those who were unprovided with so powerful an instrument, from becoming a prey to the encroachments of their more fortunate neighbours. Every individual was allowed freely to dispose of his corn, cattle, land, &c.; but it was imagined there was something peculiar in money, and that the desire to obtain it was so great, that, unless the lenders were restrained in their demands, they would, by taking advantage of the necessities of the borrowers, infallibly ruin them, and engross the whole property of the country.

Another source of the prejudice against stipulating for interest must be sought for in the dislike so universally entertained in remote ages to accumulation. There can be no accumulation without economy, without a saving of income; and this was then not only considered as indicative of a sordid and avaricious disposition, but as being positively hurtful. Before the nature and functions of capital were properly understood, it was believed that it could not be increased otherwise than by injuriously abstracting a portion of the national revenue, and that any advantage it might give to the proprietor must have been obtained at the public expense. It did not occur to our ancestors, that an individual who, by his economy, has accumulated stock, has really added to the wealth of the state, without diminishing that of others; nor were they aware that this stock, when afterwards expended, as is almost always the case, in the support of productive industry, would afford the means of producing an increased income. But reckoning, as they did, the savings of individuals as so much withdrawn from the public income, it was natural enough that they should endeavour to limit the advantage to be derived from their employment.

Much, also, of the prejudice against bargaining for interest, so prevalent in the middle ages, may be traced to the authority of some texts of Scripture, which were understood entirely to prohibit its exaction. It has, however, been shown, that these texts will not really bear this interpretation; but, supposing that they did, nothing, it is plain, could be more absurd than to consider the municipal regulations of a people placed in such peculiar circumstances as the Jews, as general and fixed principles, applicable in all ages and countries.

The attempts to limit the rate of interest, instead of reducing, have contributed to raise it.

But, whatever may have been the causes of the efforts so generally made to regulate and limit the rate of interest, it is certain that, so far from succeeding in their object, they have had a precisely opposite effect. Should a borrower find it for his advantage to offer six, seven, or eight per cent. for a loan (and unless it were for his advantage, nothing could possibly induce him to make such an offer), what right has the legislator to interfere, and to prohibit the lender from receiving, and the borrower from paying, more than four or five per cent.? Such an interference is not only uncalled for and unnecessary, but it is, in the highest degree, prejudicial. Restrictive laws, instead of reducing, have uniformly contributed to raise the rate of interest. Nor is this any thing more than might have been foreseen and expected. It is plain that no law can be so framed as to prevent a borrower from offering a higher rate of interest than what is fixed by statute; and if the lender had implicit confidence in the secrecy and solvency of the borrower, he might accommodate him with the sum wanted, without requiring any additional interest or *premium of insurance* because of the danger of entering into what the law declares to be an *illegal* transaction. But this must be a very rare case. Gratitude, and a sense of benefits received, are, unfortunately, when they come into contact with self-interest, but slender securities for honourable conduct. Numberless unforeseen events occur to weaken and dissolve the best cemented friendships; and a transaction of this kind would undoubtedly afford an additional source of jealousies and divisions. In such matters, indeed, men are more than usually sharp-sighted, and are very little disposed to trust to moral guarantees for the security of their property. But neither the threatenings of the law, nor the powerful inducements which it holds out to dishonest debtors to break their engagements, and treacherously to recede from the stipulations to which they had agreed, have been able to prevent, or even greatly to lessen, what are termed *usurious* bargains. Their only effect has been, to oblige the lender to demand, and the borrower to bind himself to pay, a higher rate of interest than would otherwise have been required. A bargain for more than the statute rate of interest being declared illegal, the lender is thus exposed to an additional *risk.* But no person will gratuitously place his fortune in a situation of comparative hazard; and, therefore, the sum necessary to cover this risk must be proportioned to the greater or less anxiety on the part of government to prevent and punish such bargains; or, in other words, the rate of interest is invariably increased according as the laws intended to reduce it become more severe, and diminished according as they are relaxed.

Thus a capitalist might be inclined to lend a sum at six or seven per cent.; but as the law declares that any individual who shall stipulate for more than five per cent. shall, if detected, forfeit *three times the principal*, it is clear, provided there was no method of defeating this statute, that there must be an end of all borrowing, except when the market rate of interest was below the statutory rate. Whenever it was above that rate, no person would be able to obtain a single farthing in the way of loan. There could, then, be no transference of capital. It would continue locked up in the same hands; and the national property and welfare would, in consequence, suffer severely. Luckily, however, the mutual interest and ingenuity of borrowers and lenders have always proved an overmatch for the enactments of the law. These have done nothing but fetter the transference of stock, and force the borrowers to pay a higher rate of interest for it. What might have been borrowed at six per cent., had there been no hazard from anti-usurious statutes, is, on account of that hazard, raised to perhaps eight or even ten per cent.; and, what is still worse, a contempt for the institutions of society, and a habit of carrying on business in a secret and underhand manner, are generated. The odium which attaches to a positively pernicious regulation, weakens the respect which would otherwise be felt for those which are acknowledged to be advantageous; and that spirit of frankness, openness, and sincerity, which, wherever it predominates, is so highly valuable, is cramped in its development, or altogether supplanted, by duplicity, extortion, and cunning.

Effect of the usury laws at Rome.

These conclusions do not rest on theory only, but are supported by a constant and uniform experience. At Rome, during the period of the republic, the ordinary rate of interest was excessively high. The debtors, or plebeians, were every now and then threatening to deprive their creditors, who were generally of the patrician

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order, not only of the interest of their capital, but of the principal itself. Repeated instances occurred to show that these were not mere empty threats; and the patricians were therefore obliged to indemnify themselves, by means of a corresponding premium, for the risks to which they were exposed. "Des continuels changements," says Montesquieu, "soit par des loix, soit par des plebiscites, naturaliserent à Rome l'usure; car les créanciers, voyant le peuple leur débiteur, leur legislateur, et leur juge, n'eurent plus de confiance dans les contrats. Le peuple, comme un débiteur decrédité, ne tentoit à lui prêter que par *des gros profits;* d'autant plus que, si les loix ne venoient que de temps en temps, les plaintes du peuple étoient continuelles, et intimidoient toujours les créanciers. Cela fit que tous les moyens honnêtes de prêter et d'emprunter furent abolis à Rome, *et qu'une usure affreuse, toujours foudroyée, et toujours renaissante, s'y établit.* Le mal venoient de ce que les choses n'avoient pas été ménagés. Les loix extrêmes dans le bien font naître le mal extréme: *il fallut payer pour le prêt de l'argent, et pour le danger des peines de la loi.*" (*Esprit des Loix*, livre xxii. chap. 21.)

In the East.

In Mahommedan countries, notwithstanding the positive prohibition in the Koran, the ordinary rate of interest is at least ten or twenty times as high as its ordinary rate in Europe. "L'usure augmente dans les pays Mahometans *à proportion de la sévérité de la defense:* le prêteur s'indemnise du péril de la contravention." (*Esprit des Loix*, liv. xxi. ch. 19.)

In the middle ages.

During the middle ages, the average rate of profit could not be much higher than at present: "But the clamour and persecution raised against those who took interest for the use of money was so violent, that they were obliged to charge it much higher than the natural price, which, if it had been let alone, would have found its level, in order to compensate for the opprobrium, and frequently the plunder, which they suffered; and hence the usual rate of interest was what we should now call most exorbitant and scandalous usury."[1] The extraordinary risks to which lenders were exposed rendered the premium of insurance on all sorts of capital excessively high; for, of the fifty and even a hundred per cent. which borrowers then frequently engaged to pay as interest, not more than eight or ten per cent. can properly be said to have been given for the productive services of capital. The rest must be considered as a *bonus*, to compensate the lender for the hazard he encountered of losing the principal itself.[2]

In France.

In France the rate of interest was fixed at five per cent. so early as 1665; and this, a few short intervals only excepted, continued to be the legal rate until the Revolution. Laverdy, in 1766, reduced it from five to four per cent. Instead, however, of the market rate being proportionably reduced, it was raised from five to six per cent. Previously to the promulgation of the edict, loans might have been obtained on good security at five per cent.; but an additional per cent. was now required to cover the risk of illegality. This caused the speedy abandonment of the measure.[3]

In Livonia.

The same thing happened in Livonia in 1786, when the Empress Catherine reduced the legal rate of interest from six to five per cent. Hitherto, says Storch (*in loco supra citato*), those who had good security to offer were able to borrow at six per cent.; but henceforth they had to pay seven per cent. or upwards. And such will be found to have been invariably the case, wherever governments have interfered to reduce the statutory below the market rate of interest.

History of the laws regulating the rate of interest in England.

From the earliest period of the history of England down to the reign of Henry VIII., the taking of interest was absolutely forbidden to all persons within the realm except Jews and foreigners, who, nevertheless, were frequently plundered for the sake of enriching the crown, under the miserable pretext of punishing them for what were then called their "hellish extortions." The disorders occasioned by this ruinous interference on the part of government at length became so obvious, that, notwithstanding the powerful prejudices to the contrary, a statute was passed in 1546 (37 Hen. VIII. cap. 7), legalizing the taking of interest to the extent of ten per cent. per annum; and this because, as is recited in the words of the act, the statutes "prohibiting interest altogether have so little force, that little or no punishment hath ensued to the offenders." In the reign of Edward VI. the horror against taking interest seems to have revived in full force; for, in 1552, the taking of *any* interest was again prohibited, "as a vice most odious and detestable," and "contrary to the word of God." But, in spite of this tremendous denunciation, the ordinary rate of interest, instead of being reduced, immediately rose to fourteen per cent., and continued at this rate until, in 1571, an act was passed (13 Eliz. cap. 8) repealing the act of Edward VI., and reviving the act of Henry VIII., allowing ten per cent. interest. In the preamble to this act it is stated, "that the prohibiting act of King Edward VI. had not done so much good as was hoped for; *but that rather the vice of usury hath much more exceedingly abounded*, to the utter undoing of many gentlemen, merchants, occupiers, and others, and to the importable hurt of the commonwealth." This salutary statute was opposed, even by those who, it might have been expected, would have been among the first to emancipate themselves from the prejudices of the age, with all the violence of ignorant superstition. Dr John Wilson, a man famous in his day, and celebrated for the extent and solidity of his learning, stated, in his place in the House of Commons, that "it was not the amount of the interest taken that constituted the crime; but that all lending for any gain, be it ever so little, was wickedness before God and man, and a damnable deed in itself, and that there was no mean in this vice any more than in murder or theft." In order to quiet the consciences of the bench of bishops, a clause was actually inserted, declaring *all* usury to have been forbidden by the law of God, and to be in its nature sin, and detestable. When first enacted, this statute was limited to a period of five years; but, "forasmuch as it was by proof and experience found to be very necessary and profitable for the commonwealth of this realm," it was, in the same reign, made perpetual. (39 Eliz. cap. 18.)

In the 21st of James I. the legal rate of interest was re-

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[1] Macpherson's *History of Commerce*, vol. i. p. 400.

[2] It is impossible to form any very accurate estimate of the rate of profit in the middle ages; yet several striking facts may be adduced in support of the opinion advanced in the text. At Verona, in 1228, the interest of money was fixed by law at twelve and a half per cent. Towards the end of the fourteenth century, the republic of Genoa paid only from seven to ten per cent. to her creditors; and the average discount on good bills at Barcelona, in 1435, is stated to have been about ten per cent. But whilst the rate of interest in Italy and Catalonia, where a considerable degree of freedom was allowed to the parties concerned in bargaining for a loan, was thus comparatively moderate, it was, in despite of its total prohibition, incomparably higher in France and England. Matthew Paris mentions that, in the reign of Henry III., the debtor paid ten per cent. every two months; and this, though absolutely impossible as a general practice, may not have been very far from the average interest charged on the few loans that were then contracted for. (Hallam's *History of the Middle Ages*, vol. iii. p. 402.)

[3] Storch, *Traité d'Economie Politique*, tome iii. p. 187.

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duced to eight per cent., by an act to continue for seven years only, but which was made perpetual in the succeeding reign. (3 Car. I. cap. 4.) During the commonwealth, the legal rate of interest was reduced to six per cent., a reduction which was afterwards confirmed by the act 12 Car. II. And, finally, in the reign of Queen Anne, a statute (12 Anne, cap. 16) was framed, reducing the rate of interest to five per cent., at which it now stands.

In the preamble to this statute, it is stated, that, "whereas the reducing interest to ten, and from thence to eight, and thence to six, in the hundred, hath from time to time, by experience, been found very beneficial to the advancement of trade and the improvement of lands, it is become absolutely necessary to reduce the high rate of interest of six per cent. to a nearer proportion to the interest allowed for money in foreign states." It was for these reasons enacted, that all bargains or contracts stipulating for a higher rate of interest than five per cent. should be utterly void. And "that all persons who should after that time receive, by means of any corrupt bargain, loan, exchange, chevizance, or interest, of any wares, merchandise, or other thing whatever, or by any deceitful way or means, or by any covin, engine, or deceitful conveyance for the forbearing or giving day of payment, for one whole year, for their money or other thing, above the sum of L.5 for L.100 for a year, should forfeit, for every such offence, the *triple* value of the monies or other things so lent, bargained," &c.

Laws regulating the rate of interest in Scotland.

In Scotland, previously to the Reformation, no interest could be legally exacted for money. But this great event, by weakening the force of those religious prejudices, which had chiefly dictated the laws prohibiting interest, occasioned the adoption of sounder opinions on the subject, and led to the enactment of the statute of 1587 (11 Parlt. Jac. VI. cap. 52), which legalized the taking of interest to the extent of ten per cent. In 1633 the legal rate was reduced to eight per cent., and in 1661 to six per cent. The statute of Queen Anne, reducing the rate of interest to five per cent., extended to both kingdoms.

In Ireland.

The statutes prohibiting the taking of interest in Ireland were not repealed until 1635, when, by the statute 10 Car. I. cap. 22, liberty was given to stipulate for interest to the extent of ten per cent. In 1704 this rate was reduced to eight per cent.; in 1722 it was reduced to seven per cent.; and in 1732 it was further reduced to six per cent., at which it has since continued fixed.

Comparison between the market rate and the statutory rate of interest, from 1714 to 1793.

It has been observed by Dr Smith, that the different statutory regulations, reducing the rate of interest in England, were made with great propriety. Instead of preceding, they followed the fall which was gradually taking place in the market rate of interest; and, therefore, did not contribute, as they otherwise must have done, to raise the rate which they were intended to reduce. Sir Josiah Child, whose celebrated Treatise, recommending a reduction of interest to four per cent. was published about 1670, states positively, that the goldsmiths in London, who then acted as bankers, could obtain as much money as they pleased, upon their servants' notes only, at four and a half per cent. The supposed insecurity of the revolutionary establishment, and the novelty of the practice of funding, occasioned the payment of a high rate of interest for a considerable portion of the sums borrowed by the public in the reigns of William III. and Anne; but private persons, of undoubted credit, could then borrow at less than five per cent. During the reign of George II. the market rate of interest fluctuated from three to four and four and a half per cent.[1]

Dr Smith mentions, that the increased means of profitably investing capital acquired during the war which terminated in 1763, raised the market rate of interest, subsequently to the peace of Paris, to a level with the statutory rate, or perhaps higher. But this rise was only temporary, and it was not until the late war that any very material or general inconvenience was found to result from the limitation of the rate of interest to five per cent.

Expediency for defeating the laws limiting the rate of interest.

It is necessary, however, to observe, that this remark applies exclusively to the loans negotiated by individuals who could offer unexceptionable security; for, ever since the passing of the act 1714, persons engaged in employments of more than ordinary hazard, whose character for prudence and punctuality did not stand high, or who could only offer inferior security, were unable to borrow at five per cent., and have in consequence been compelled to resort to a variety of schemes for defeating and evading the enactments in the statute. The most common device was the sale of an annuity. Thus, supposing an individual whose personal credit was not good, and who had only the liferent of an estate to give in security, wanted to borrow any given sum, he sold an annuity to the lender sufficient to pay the interest stipulated for, which, because of the risks and odium attending such transactions, was always higher than the market rate, and also to pay the *premium* necessary to insure payment of the principal on the death of the borrower. It is curious to observe, that although the sale of an *irredeemable* life annuity, at a rate exceeding legal interest, was not reckoned fraudulent or usurious; yet, so late as 1743, Lord Hardwicke held, that in their less exceptionable form, or when they were *redeemable*, annuities could only be looked upon as an evasion of the statute of usury, and a loan of money.[2] But the extreme inexpediency of this distinction soon became obvious, and the law on this subject is now entirely changed. The greater extension of the traffic in annuities, and the advantage of giving as much publicity as possible to such transactions, led to various parliamentary inquiries and regulations respecting them in the early part of the reign of his late majesty. The consequence has been, that irredeemable annuities are now nearly unknown, and that the sale of a redeemable annuity cannot be impeached, although it should appear on the face of the deeds that the lender had secured the principal by effecting an assurance of the borrower's life.[3]

During the greater part of the late war, however, the usury laws operated, not to the prejudice of one, but of all classes of borrowers. The extent of the loans, the high rate of interest given by the state, the facility of selling out of the funds, the regularity with which the dividends were paid, and the temptations arising from the fluctuations in the price of funded property, diverted so large a proportion of the floating capital of the country into the coffers of the treasury, as to render it next to impossible for a private individual to borrow at the legal rate of interest, except from the trustees of public companies, or

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[1] On the 18th of December 1752, the three per cents. brought the highest price they have hitherto reached, namely, 106⅝ per cent. On the 20th of September 1797, the day on which the failure of Lord Malmesbury's attempt to negotiate with the French republic transpired, consols fell to 47⅞, being the lowest price at which they have ever been sold.

[2] *Considerations on the Rate of Interest*, by E. B. Sugden, Esq. *Pamphleteer*, vol. viii. p. 278.

[3] By the act 53 Geo. III. cap. 141, it is enacted, "That a memorial, setting forth the date of every deed, bond, instrument, or other assurance, whereby an annuity or rent-charge shall be granted for one or more life or lives, or for a certain number of years, the names of all the witnesses, and of all the parties thereto, the sum given for the security, and the amount of the annuity itself, shall be registered in the Court of Chancery." This act only applies to England and Wales.

through the influence of circumstances of a very peculiar nature. The proprietors of unencumbered freehold estates, of which they had the absolute disposal, were almost universally obliged to resort to those destructive expedients which had formerly been the resource only of spendthrifts, and persons in the most desperate circumstances. Annuities were not unfrequently granted for the term of several lives, at the rate of twelve, fourteen, fifteen, and even twenty per cent., exclusive of the premium of insurance on the lives of the persons named in the grant of the annuities. Mr Onslow, in his speech on the usury laws, 23d of May 1816, mentions that he knew the case of a gentleman possessed of a very large estate in *fee-simple*, who had been compelled to grant an annuity for *four* lives (and the survivor of them), named by the grantee, for *eight* years' purchase.

House of Commons' Report on the Usury Laws.

The Report of the Committee on the Usury Laws, laid before the House of Commons in 1818, contains much valuable evidence, establishing the impolicy and the pernicious effects of these laws in the clearest manner. Mr Sugden, a gentleman very extensively concerned in the management of landed property, stated, that when the market rate of interest rose above the legal rate, the landed proprietor was compelled to resort to some shift to evade the usury laws. For this purpose, Mr Sugden informed the committee he had "known annuities granted for *three* lives, at ten per cent. upon fee-simple estates, unencumbered, and of great annual value, in a register county. He had also known annuities granted for *four* lives, and more would have been added, but for the danger of equity setting aside the transaction on account of the inadequacy of the consideration. Latterly many annuities were granted for a term of years certain, not depending upon lives." On being asked whether, if there were no laws limiting the rate of interest, better terms could or could not have been obtained, Mr Sugden answered, "I am decidedly of opinion that *better terms* could have been obtained; for there is a stigma which attaches to men who lend money upon annuities, that drives all respectable men out of the market. Some leading men did latterly embark in such transactions, but I never knew a man of reputation in my own profession lend money in such a manner, although we have the best means of ascertaining the safest securities, and of obtaining the best terms. In all loans, two solicitors are invariably concerned, one for the borrower and one for the lender; and although the borrower always pays the expense of the securities, yet a regular professional bill is invariably made out; whereas, in the case of an annuity, although it is in strictness a loan, only one solicitor is employed, and he never makes out a regular bill, but charges what is termed a *lumping sum*, for all his expense and trouble in the transaction." And, in another place, Mr Sugden observes, "the temptation on the part of a solicitor to lend money upon annuities is very strong, because, *without any check upon his charges, he demands whatever sum he pleases, and he takes care that it is instantly paid; for in no instance is the borrower allowed to leave the room until he has paid the solicitor's charge.*" "Nothing," Mr Sugden justly adds, "short of *a repeal of the usury laws* can put a stop to the abuses which attend grants of annuities: they strongly encourage a spirit of gambling; for, as the repayment of the money lent cannot be enforced, and the annuity is granted upon a contingency, the borrower too frequently neglects to provide for the payment of the loan, and trusts to chance for the determination of the annuity."

"The laws against usury," says Mr Holland, partner of the house of Baring, Brothers, and Company, and one of the best informed merchants in the country, "drive men in distress, or in want of money, to much more disastrous modes of raising it than they would adopt if no usury laws existed. The landowner requires capital to increase his live stock, or improve his land, or for any other purpose, at a period when the government is borrowing money at above five per cent., or when the funds give a greater interest than five per cent.; no one will then lend to the landowner, because his money is worth more to him than the law allows him to take; the landowner must, therefore, either give up his improvements, or borrow money on annuity interests, on much more disadvantageous terms than he could have done if no law existed against usury. The man in trade, in want of money for an unexpected demand, or disappointed in his returns, must fulfil his engagements, or forfeit his credit. He might have borrowed money at six per cent., but the law allows no one to lend it to him, and he must sell some of the commodity he holds, at a reduced price, in order to meet his engagements. For example, he holds sugar which is worth 80s.; but he is compelled to sell it immediately for 70s. to the man who will give him cash for it, and thus actually borrows money at twelve and a half per cent., which, had the law allowed him, he might have borrowed from a money dealer at six per cent. It is known to every merchant, that *cases of this kind are common occurrences in every commercial town, and more especially in the metropolis.* A man in distress for money pays more interest, owing to the usury laws, than he would if no such laws existed; because now he is obliged to go to some of the disreputable money lenders to borrow, as he knows the respectable money lender will not break the laws of his country. The disreputable money lender knows that he has the *ordinary risk* of his debtor to incur in lending his money, and he has further to encounter the *penalty of the law*, for both of which risks the borrower must pay. If no usury laws existed, in common cases, and where a person is respectable, he might obtain a loan from the respectable money lender, who would then only have to calculate his ordinary risk, and the compensation for the use of his money."

Resolutions of the committee.

In every part of the appendix to the *Report*, we meet with equally conclusive evidence of the pernicious effects of the laws restraining the rate of interest. And the committee admitted the full force of this evidence, by agreeing to the following resolutions: 1*st*, "That it is the opinion of this committee, that the laws regulating or restraining the rate of interest have been extensively evaded, and have failed of the effect of imposing a maximum on such rate; and that, of late years, from the constant excess of the market rate of interest above the rate limited by law, they have added to the expense incurred by borrowers on real security, and that such borrowers have been compelled to resort to the mode of granting annuities on lives; a mode which has been made a cover for obtaining a higher rate of interest than the rate limited by law, and has farther subjected the borrowers to enormous charges, or forced them to make very disadvantageous sales of their estates. 2*d*, That it is the opinion of this committee, that the construction of such laws, as applicable to the transactions of commerce as at present carried on, have been attended with much uncertainty as to the legality of many transactions of frequent occurrence, and consequently been productive of much embarrassment and litigation. 3*d*, That it is the opinion of this committee, that the present period, when the market rate of interest is below the legal rate, affords an opportunity peculiarly favourable for the repeal of the said laws."

In spite, however, of the recommendation of the committee, and of the clear and satisfactory nature of the evidence on which it is founded, the popular prejudice on this subject continues so strong, that there does not seem much reason to expect that this desirable measure will be speedily effected.

Pernicious effects of laws.

It is most absurdly supposed, that, were the laws limiting the rate of interest repealed, every individual who has

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capital to lend would henceforth indulge in all those mean and disgraceful practices which at present characterise the lowest class of money brokers. But it might just as reasonably be supposed, that were country gentlemen allowed to sell game, they would immediately become addicted to all the vices of the poacher. The truth is, that if the rate of interest was left to be adjusted by the unrestricted competition of the parties, there would be almost no employment for the inferior class of money dealers. Except when the *market* rate of interest is below the *legal* rate, the usury laws prevent all persons, whose credit is not extremely good, from obtaining loans from capitalists of the highest character, and force them to have recourse to those who are less scrupulous. Supposing the market rate of interest to be six or seven per cent., an individual in ordinarily good credit might, were the usury laws abolished, easily obtain a loan at that rate. But the law having declared that no more than five per cent. shall be taken, and consequently having affixed a species of stigma to those lenders who bargain for a higher rate, necessarily excludes the rich and more respectable capitalists from the market, and obliges borrowers to resort to those of an inferior character, who, in addition to the premium for the risk incurred by entering into an illegal transaction, must receive an indemnification for the *odium* which, in such cases, always attaches to the lender. It is idle and ridiculous to attempt to secure individuals against the risk of imposition in pecuniary, more than in any other species of transactions. But although the object were really desirable, it could not possibly be obtained by such inadequate means. The usury laws generate the very mischief they are intended to suppress. Far from diminishing, they most unquestionably multiply usurious transactions in a tenfold proportion, and powerfully aggravate all the evils they were designed either to mitigate or remove.

Nothing can be more unreasonable, or more entirely unfounded, than the clamour that has been set up against usurers, as money-lenders are sometimes termed, because of their exacting a higher rate of interest than ordinary from prodigals and spendthrifts. This, surely, is the most proper and efficient check that can be put upon the thoughtless or unprincipled extravagance of such persons. Supposing the security of a prodigal and of an industrious man to be nearly equal, and this can scarcely ever be the case, does not the capitalist who would lend to the latter at a lower rate of interest than he would lend to the former, confer a real service on his country? Does he not prevent those funds which ought to be employed in supporting useful labour, and in adding to the real wealth of the nation, from being wasted in ridiculous extravagances or boisterous dissipation?

They do not protect the prodigal and unwary.

But, perhaps, we shall be told, that this is mistaking the object of the usury laws; that they were not intended to force capitalists to lend to spendthrifts at the same rate of interest as to industrious persons, but to protect the prodigal and unwary from the extortion of usurers, by declaring any stipulation between them for more than a given rate of interest to be null and void. But why all this solicitude about the least valuable class of society? Why fetter and restrict the free circulation of capital amongst those who would turn it to the best account, lest any portion of it might chance to fall into the hands of those who would squander it away? If the prevention of prodigality be an object of sufficient importance to justify the interference of the legislature, why not at once put the prodigal under an *interdict?* This is the only way in which it is possible to restrict him. It is not so much by borrowing money at high interest, as by contracting debts to merchants, on whose charge there is no check, that spendthrifts generally run through their fortunes. Mr Bentham has justly observed, that so long as a man is looked upon as one who will pay, he can much easier get the goods he wants than he could the money to buy them with, though he were content to give for it twice or thrice the ordinary rate of interest. How ridiculous is it, then, to stimulate this natural facility of purchasing, to permit prodigals to borrow (for it is really borrowing) the largest supplies of food, clothes, &c. at twenty, thirty, or even a hundred per cent. interest, at the same time that we inflict a real injury on every other class of society, rather than permit them to borrow the smallest supply of money at more than five per cent. Instead of being of any service, this restriction is evidently injurious to the prodigal. It narrows his choice, and drives him from a market which might have proved much less disadvantageous, to one in which no disgrace attaches to the exaction of the most exorbitant interest, and where he can scarcely escape being ruined.

Neither is the outcry raised against capitalists for taking advantage of the necessities of industrious individuals, in any degree better founded than that which is raised against them for taking advantage of the extravagant and thoughtless disposition of the prodigal or the simple. According as a person has a character for sobriety, and for punctuality in making his engagements, and according to the presumed state of his affairs at the time, so will he be able to borrow. To say that a capitalist took advantage of the necessities of any individual, is only saying that he refused to lend to a person in suspicious or necessitous circumstances, at the same rate of interest he would have done had he been in high credit, or, which is the same thing, had there been no *risk* of losing the principal; and had he not acted in this manner, should we not have justly considered him as a fool or a madman?

But, as has already been shown, whatever may be the extortion of lenders, the usury laws afford no means of checking it; on the contrary, they compel the borrowers to pay, over and above the common rate of interest, a *premium* sufficient to indemnify the lender for the risk and odium incurred in *breaking them.* They attempt to remedy what is not an evil, and what, consequently, ought not to be interfered with; and in doing this they necessarily create a real grievance. What should we have thought of an act of parliament to compel the underwriters to insure a gunpowder magazine and a salt warehouse on the same terms? Yet this would not have been in any respect more absurd than to enact that the same rate of interest should be charged on capital lent to those whose security is widely different.

There were no usury laws in Holland.

Luckily we are not left to infer from general principles, however well established, the many advantages that would result from a repeal of the laws limiting the rate of interest. The case of Holland furnishes a practical and striking proof of the correctness of the theory we have been endeavouring to establish. It is an undoubted fact, that the rate of interest has been, for a very long period, lower in Holland than in any other country in Europe; and yet Holland is the only country in which usury laws are altogether unknown, where capitalists are allowed to demand, and borrowers to pay, any rate of interest.[1] Notwithstanding all the violent changes of the government, and the extraordinary derangement of her financial concerns in

[1] Strictly speaking, this applies only to the state of Holland previously to the Revolution in 1795. The enactments of the Code Napoleon were subsequently introduced; but it appears, from the Report of the Parliamentary Committee on the Usury Laws, that they have not, in any instance, been acted upon.

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the course of the last twenty years, the rate of interest in Holland has continued comparatively steady. During the whole of that period, persons who could offer unexceptionable security have been able to borrow at from three to five and a half per cent.; nor has the average rate of interest charged on capital, advanced on the worst species of security, ever exceeded six or seven per cent., except when the government was negotiating a forced loan.[1] But, in this country, where the law declares that no more than five per cent. shall be taken, the rate of interest for capital advanced on the best landed security has, in the same period, varied from five to sixteen or seventeen per cent., or *five* times as much as in Holland. Surely this ought to put to rest all doubts as to the impolicy and the inefficiency of the usury laws.

Legal rate of interest in France;

In France the usury laws were abolished at the Revolution; and it is distinctly stated, that their abolition *was not attended by any rise of interest.*[2] According to the *Code Napoleon*, only six per cent. interest is allowed to be taken in commercial affairs, and five per cent. when money is advanced on the security of real property. There is not, however, any difficulty in evading this law. The method resorted to for this purpose, is to give a *bonus* before completing the transaction, or, which is the same thing, to frame the obligation for the debt for a larger sum than was really advanced by the lender. None of the parties particularly interested can be called to swear to the fact of such a *bonus* being given; so that the transaction is unimpeachable, unless a third party, who was privy to the settling of the affair, can be produced as a witness. The Bank of France never discounts at a higher rate of interest than five per cent., but sometimes at a lower rate.

In Hamburg;

In Hamburg the rate of interest is quite unrestricted; or, if there be a written law restraining it, it has become altogether obsolete. The rate, therefore, varies according to circumstances. Occasionally it has been at seven, eight, and even ten per cent.; and, in 1799, a period of great mercantile embarrassment and insecurity, it was as high as fourteen per cent. Generally, however, the rate of discount on good bills does not exceed four or five per cent.[3]

In Russia;

In Russia the legal rate of interest is six per cent. But as Russia is a country capable of much improvement, and where there are very great facilities for the advantageous employment of capital, the market rate of interest is invariably higher than the statute rate, and the law is as constantly as it is easily evaded.[4]

In Austria;

At Trieste, and throughout the Austrian empire in general, the usual rate of interest is fixed by law at six per cent.; but capital can seldom be obtained for less than eight or ten per cent.[5]

In Leghorn;

At Leghorn the ordinary rate of interest is a half per cent. per month, or six per cent. per annum; but there is no law to prevent the taking of a higher rate.

In Spain;

In Spain the ordinary rate of interest is six per cent.; but no law exists against taking a higher rate, and it seldom falls below five or rises above seven per cent.

In the United States.

In the United States legal interest is fixed at six per cent.; but the market rate fluctuates from ten to twelve per cent. Efforts, Mr Birkbeck informs us, are now making in various parts of the Union, particularly in Virginia and North Carolina, to do away the restraints on usury, which, as he justly observes, "*operate merely as a tax on the needy borrower.*"[6]

Usury laws do not reach the government.

If usury laws are to have any existence, they ought certainly to be made to operate on the greatest of all borrowers; on those who do not borrow on their own credit, but on that of others. Is it not the extreme of folly, that, whilst an industrious manufacturer, or agriculturist, is prevented from giving more than five per cent. for capital, which he might be able to invest so as to yield ten or twelve per cent., government should be allowed to borrow at six, eight, ten, or twenty per cent.? What is this but holding out a bait to loan-mongers, and causing the capital of the country to flow with an accelerated and unnatural velocity into the treasury? Nothing surely can be more impolitic than this. If we are to have usury laws, they ought to operate alike on every class of borrowers; and, considering the superior attractions which the facility of repossessing the principal gives to the investment of capital in the funds, the rate of interest at which government should be allowed to borrow should be *less* than the rate at which private individuals might borrow.

We trust, however, that we have said enough to show the inexpediency and the pernicious tendency of all such regulations. If a landlord is to be allowed to take the highest rent he can get offered for his land, a farmer the highest price for his raw produce, a manufacturer for his goods, why should a capitalist be restricted and fettered in the employment of his stock? Every principle of natural justice, and of sound political expediency, is outraged by such a distinction.

So long as the market rate of interest continued higher than the statutory rate, it cannot be doubted that considerable inconvenience would have resulted from any *sudden* abolition of the usury laws. It is certain, indeed, that this inconvenience would have been very speedily compensated by the check which the abolition would have given to the traffic in annuities, and by the easier circulation and more advantageous distribution of capital. Now, however, when the market is fallen below the statutory

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[1] The general rate of discount in Holland is from four to five per cent., and occasionally from three to three and a half per cent., but very seldom lower. During the Revolution it had been at six and seven per cent., and even at eight; but this was generally owing to some *forced financial operation* on account of the government, and was never of long duration. The following is the average rate of discount at Amsterdam and Rotterdam from 1795 to 1817:

1795—4, 4½, 5, 6.
1796—4, 4½, 5, 6.
1797—4, 4½, 5, 5½, 6, 9, 12.
1798—4, 4½, 5, 5.
1799—3, 4, 4½, 5.
1800—4, 4½, 5, 6.
1801—4, 4½, 5, 6.
1802—4½, 5, 5½, 6.
1803—4, 5, 5½, 6.
1804—4, 4½, 5, 5½, 6.
1805—4, 5, 5½, 6, 9.
1806—4, 4½, 5, 5½, 6, 9.
1807—4, 4½, 5, 6.
1808—4, 3½, 4½, 5, 6.
1809—4, 4½, 5, 6.
1810—4, 4½, 5, 6.
1811—3, 3½, 4, 5.
1812—3, 3½, 4, 5.
1813—3, 3½, 4, 5, 6.
1814—4, 5, 5½, 5, 6, 6½.
1815—5½, 6, 6½, 7.
1816—5, 5½, 6, 6½, 7.
1817—5, 5½, 6.

"The bank of Amsterdam never discounts at a higher rate than five per cent.; but they discount at a lower rate, and vary their discounts according to the abundance of capital, never exceeding five per cent., and occasionally as low as two and a half and three." (Mr Holland's evidence, *Report of the Committee on the Usury Laws*, p. 45.)

[2] Storch, *Economie Politique*, tome iii. p. 187.

[3] *Report on Usury Laws*, p. 46.

[4] *Ibid.* and Storch, tome iii. p. 207.

[5] See Report, *ubi supra.*

[6] *Letters from Illinois*, p. 36.

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rate of interest, no inconvenience could attend their repeal. It could not lead to any demand for payment of borrowed money, for no individual would require payment of what he could not relend to greater advantage. But, while their repeal would be in no respect disadvantageous, it would enable those who are engaged in employments of more than ordinary hazard, to procure adequate supplies of stock on more favourable terms; and it would also secure us against the risk of future mischief should the market again rise above the legal rate of interest. It is unnecessary, however, to urge the *immediate* repeal of the usury laws. We think it quite visionary to apprehend any danger from the instant application of a sponge to the whole of the anti-usurious statutes, but it is enough if they are repealed *gradually*. To avoid exciting any alarm in the minds of the most timid, the rate at which capital may be legally lent at interest might be annually raised *one* or *one half* per cent., until the rate had been extended to eight or ten per cent., when it is clear every restrictive regulation might be abolished, without the possibility of the smallest derangement happening in consequence.

Were the usury laws abolished, it would be proper to frame a statute which should fix the interest to be paid in those cases in which no previous agreement had been made respecting it. But as, in cases of this description, there is very frequently considerable doubt whether it was the intention of the parties at the time the transaction took place, that any interest should be charged, it would be proper to give the borrower the full benefit of this doubt, by fixing the rate payable in such cases at the lowest market rate.

Error of some writers on the subject of a low rate of interest.

Before concluding, we may remark, that, until the laws regulating the rate of profit and the increase of capital had been accurately investigated, the great wealth and commercial prosperity of Holland was invariably appealed to as a practical proof of the advantages of a low rate of interest. But Sir Josiah Child, and those who have insisted so much on this example, forget that the lowness of interest in Holland was the necessary effect of the circumstances in which that country was placed; of the lowness of profits, caused by the oppressiveness of taxation, and the deficient supply of fertile soil, and not of any *interference* on the part of the government. Neither was this lowness of interest any advantage, but a positive disadvantage. A country, whose average rate of profit, and consequently of interest, has been reduced considerably below the level of surrounding nations, may, notwithstanding, abound in wealth, and be possessed of an immense capital; but it would be the height of error to suppose that this reduction of profits and interest could have facilitated their accumulation. Capital cannot be accumulated otherwise than by a saving of income; and wherever incomes are large, and this will always be the case where the rate of profit is comparatively high, there must be a proportionably increased facility of gratifying the prevalent passion for accumulation. The case of Holland, far from contradicting, furnishes a striking example of the truth of this principle. Sir William Temple mentions that her trade was rather on the decline in 1670; and the large capital of which she was then in possession had been accumulated previously to her wars with Cromwell, and when the rate of profit was much higher than at any subsequent period. Low profits are a certain proof that society has become clogged in its progress. They show that it is approaching, if it has not already reached, the stationary state, and that, unless measures can be devised for relieving the pressure on the resources of the state, it will be thrown back in the career of improvement, and outstripped by its neighbours. The rate of profit and the rate of interest are ordinarily twice as high in the United States as in Great Britain or France, and it is to this that the more rapid advancement of the former in wealth and population is entirely to be ascribed. High profits, it is true, may not in every instance be accompanied by a great degree of prosperity; for a despotic government, or the want of sufficient protection, may paralyze all the efforts of those who are otherwise placed in the most favourable circumstances for the accumulation of wealth. But, *if the government be equally liberal, and if property be equally well secured, the degree of national prosperity will be correspondent to the rate of profit.* The demand for labour, or, which is in effect the same thing, the funds for supporting the largest and most valuable portion of society, increase or diminish in exact proportion to the increase or diminution of profits. Wherever they are high, the labourer is well paid, and the society rapidly augments both its population and its riches; on the other hand, wherever they are low, the demand for labour is proportionably reduced, and the progress of society rendered so much the slower.

Instead, therefore, of a low rate of profit, and a low rate of interest, for the one must be always directly as the other, being any proof of the flourishing situation of a country, it is distinctly and completely the reverse. High profits show that capital may be readily and beneficially invested in the different branches of industry, and wherever this is the case, it will be better for the borrower to pay a high rate of interest than it would be for him to pay a lower rate, in countries where there is less facility of employing his stock with advantage. The borrower who pays ten or twelve per cent. for capital in the United States generally makes a more profitable bargain than the English borrower who pays only four or five per cent. It is obviously not by the circumstance of the rate of interest payable on loans being absolutely high or low, but by the proportion between that rate and the average rate of profit, that we must determine whether they have been obtained on favourable or unfavourable terms. (C. C.)

INTERJECTION, in *Grammar*, an indeclinable part of speech, expressive of some passion or emotion of the mind. See GRAMMAR.

INTERIM, a name given to a formulary, or kind of confession, of the articles of faith, obtruded upon the Protestants after Luther's death by the Emperor Charles V. when he had defeated their forces; and so called because it was only to take place in the *interim* (mean time), till a general council should have decided all points in dispute between the Protestants and Catholics. It retained most of the doctrines and ceremonies of the Catholics, excepting that of marriage, which was allowed to the clergy, and communion to the laity under both kinds. Most of the Protestants rejected it. There were two interims besides this; the one of Leipsic, and the other of Franconia.

INTERLOCUTOR, in *Scotch Law*, is the decision or judgment of a court before the final decree is passed and extracted.

INTERLOCUTORY DECREE, in *English Law*. In a suit in equity, if any matter of fact be strongly controverted, the fact is usually directed to be tried at the bar of the Court of King's Bench, or at the assizes, upon a feigned issue. If a question of mere law arises in the course of a cause, it is the practice of the Court of Chancery to refer it to the opinion of the judges of the Court of King's Bench, upon a case stated for that purpose. In such cases, interlocutory decrees or orders are made.

Interlocutory Judgments are such as are given in the middle of a cause, upon some plea, proceeding on default, which is not intermediate, and does not finally determine or complete the suit. But the interlocutory judgments most usually spoken of are those incomplete judgments by which the right of the plaintiff is established, but the quantum of damages sustained by him is not ascertained, which is the province of a jury. In such a case a writ of inquiry issues to the sheriff, who summons a jury, inquires of the damages, and returns to the court the inquisition so taken, whereupon the plaintiff's attorney taxes costs, and signs final judgment.

Interlocutory Order, that which decides not the cause, but only settles some intervening matter relating to the cause; as where an order is made in chancery, for the plaintiff to have an injunction to quit possession till the hearing of the cause. This order, not being final, is called *interlocutory*.

INTERLOPERS are properly those who, without due authority, hinder the trade of a company or corporation lawfully established, by dealing in the same way.

INTERLUDE, an entertainment exhibited on the theatre between the acts of a play, to amuse the spectators, or to give time for changing the scenes and decorations. In the ancient tragedy, the chorus sung the interludes, to show the intervals between the acts. Interludes, amongst us, usually consist of songs, dances, feats of activity, concerts of music, and the like. Aristotle and Horace lay it down as a rule, that the interludes should consist of songs founded on the principal parts of the drama; but since the chorus has been discontinued, dancers, buffoons, and such like performers, ordinarily furnish the interludes.

INTERMENT, the act of interring, that is, burying or laying a deceased person in the ground.

Aristotle asserted that it was more just to assist the dead than the living. Plato, in his Republic, does not forget, amongst other acts of justice, that which concerns the dead. Cicero establishes three kinds of justice; the first respects the gods, the second the manes or dead, and the third men. These principles seem to be derived from nature; and they appear at least to be necessary for the support of society, since civilized nations have at all times taken care to bury their dead, and to pay the last respects to their remains.

We find in history several traces of the respect which the Indians, the Egyptians, and the Syrians entertained for the dead. The Syrians embalmed their bodies with myrrh, aloes, honey, salt, wax, bitumen, and resinous gums; and they also dried them with the smoke of the fir and of the pine tree. The Egyptians preserved theirs with the resin of the cedar, with aromatic spices, and with asphaltum. These people often kept such mummies, or at least their effigies, in their houses; and at grand entertainments they were introduced, that by reciting the great actions of their ancestors they might be the more excited to virtue.

The Greeks, at first, had probably not the same veneration for the dead as the Egyptians. Empedocles, therefore, in the eighty-fourth Olympiad, restored to life Ponthia, a woman of Agrigentum, who was about to be interred. But this people, in proportion as they became more enlightened, perceived the necessity of establishing laws for the protection of the dead.

At Athens the law required that no person should be interred before the third day; and in the greater part of the cities of Greece a funeral did not take place till the sixth or even the seventh day. When a man appeared to have breathed his last, his body was generally washed by his nearest relations, with warm water mixed with wine. They afterwards anointed it with oil; and covered it with a dress commonly made of fine linen, according to the custom of the Egyptians. This dress was white at Messina, Athens, and in the greater part of the cities of Greece, where the dead body was crowned with flowers. At Sparta it was of a purple colour, and the body was surrounded with olive leaves. The corpse was afterwards laid upon a couch in the entry of the house, where it remained till the time of the funeral. At the magnificent obsequies with which Alexander honoured Hephæstion, the body was not burned until the tenth day.

Interment.

The Romans, in the infancy of their empire, paid as little attention to their dead as the Greeks had done. Acilius Aviola having fallen into a lethargic fit, was supposed to be dead; he was therefore carried to the funeral pile; the fire was lighted up; and though he cried out he was still alive, he perished for want of speedy assistance. The prætor Lamia met with the same fate. Tubero, who had been prætor, was saved from the funeral pile. Asclepiades, a physician, who lived in the time of Pompey the Great, about one hundred and twenty years before the Christian era, returning from his country-house, observed near the walls of Rome a grand convoy and a crowd of people, who were in mourning, assisting at a funeral, and showing every exterior sign of the deepest grief. Having asked what was the occasion of this concourse, no one made any reply. He therefore approached the pretended dead body; and imagining that he perceived signs of life in it, he ordered the bystanders to take away the flambeaux, to extinguish the fire, and to pull down the funeral pile. On this a kind of murmur arose throughout the whole company. Some said that they ought to believe the physician, whilst others turned both him and his profession into ridicule. The relations, however, yielded at length to the remonstrances of Asclepiades; they consented to defer the obsequies for a little; and the consequence was that the pretended dead person was restored to life. It appears that these examples, and several others of a similar kind, induced the Romans to delay funerals longer, and to enact laws to prevent precipitate interments.

At Rome, after allowing a sufficient time for mourning, the nearest relation generally closed the eyes of the deceased; and the body was bathed with warm water, either to render it fitter for being anointed with oil, or to re-animate the principle of life, which might remain suspended without manifesting itself. Proofs were afterwards made to discover whether the person was really dead, and these were often repeated during the time that the body remained exposed; for there were persons appointed to visit the dead, and to prove their situation. On the second day, after the body had been washed a second time, it was anointed with oil and balm. Luxury increased to such a pitch in the choice of foreign perfumes for this purpose, that under the consulship of Licinius Crassus and Julius Cæsar, the senate forbade any perfumes to be used except such as were the production of Italy. On the third day the body was clothed according to its dignity and condition. The robe called the *prætexta* was put upon magistrates, and a purple robe upon consuls. For conquerors who had merited triumphal honours, this robe was of gold tissue; for other Romans it was white, and for the lower classes of the people black. These dresses were often prepared at a distance, by the mothers and wives of persons still in life. On the fourth day the body was placed on a couch, and exposed in the vestibule of the house, with the visage turned towards the entrance, and the feet near the door; and in this situation it remained till the end of the week. Near the couch were lighted wax-tapers, a small box in which perfumes were burned, and a vessel full of water for purification, with which those who approached the body besprinkled

Interment. themselves. An old man belonging to those who furnished every thing necessary for funerals sat near the deceased, with some domestics clothed in black. On the eighth day the funeral rites were performed; but, to prevent the body from corrupting before that time, salt, wax, the resinous gum of the cedar, myrrh, honey, balm, gypsum, lime, asphaltum or bitumen of Judæa, and several other substances, were employed. The body was carried to the pile with the face uncovered, unless wounds, or the nature of the disease, had rendered it loathsome and disgusting. In such a case a mask was used, made of a kind of plaster, which has given rise to the expression of *funera larvata,* used in some of the ancient authors. This was the last method of concealment which Nero made use of, after having caused Germanicus to be poisoned; for the effect of the poison had become very sensible, by livid spots, and the blackness of the body; but a shower of rain happening to fall, it washed the plaster entirely away, and thus the horrid crime of fratricide was discovered.

In the primitive church the dead were washed and then anointed; the body was wrapped up in linen, or clothed in a dress of more or less value according to circumstances, and it was not interred until after being exposed and kept some days in the house. The custom of clothing the dead is in France observed only in the case of princes and ecclesiastics.

Notwithstanding the customs above recited, still, in many places, and on numerous occasions in all places, too much precipitation attends this last office; or, if not precipitation, a neglect of due precautions in regard to the body.

A man may fall into a syncope, and remain in that condition for a very considerable period of time. People in this situation have been known to come to life when deposited amongst the dead. A boy belonging to the hospital at Cassel appeared to have breathed his last; he was carried into the hall where the dead were exposed, and was wrapped up in a piece of canvass. Some time afterwards, recovering from his lethargy, he recollected the place in which he had been deposited, and crawling towards the door, knocked against it with his foot. This noise was luckily heard by the sentinel, who soon perceiving the motion of the canvass, called for assistance. The youth was immediately conveyed to a warm bed, and soon perfectly recovered. Had his body been confined by close bandages or ligatures, he would not have been able, in all probability, to make himself be heard; his unavailing efforts would have made him again fall into a syncope, and he would have thus been buried alive.

We must not be astonished that the servants of an hospital should take a syncope for a real death, since even the most enlightened persons have sometimes fallen into errors of the same kind. Dr John Schmid relates, that a young girl, seven years of age, after being afflicted for some weeks with a violent cough, was all of a sudden freed from this troublesome malady, and appeared to be in perfect health. But some days afterwards, whilst playing with her companions, the child fell down in an instant, as if struck by lightning. A death-like paleness was diffused over her face and arms; she had no apparent pulse, her temples were sunk, and she showed no signs of sensation when shaken or pinched. A physician, who was called, and who believed her to be dead, in compliance with the repeated and pressing request of her parents, attempted, though without any hopes, to recall her to life; and at length, after several vain efforts, he made the soles of her feet be smartly rubbed with a brush dipped in very strong pickle. At the end of three quarters of an hour she was observed to sigh; she was then made to swallow some spirituous liquor; and she was soon afterwards restored to life, much to the joy of her disconsolate parents. A certain man having undertaken a journey in order to see his brother, on his arrival at his house found him dead. This news affected him so much that it brought on syncope, and he himself was supposed to be in the like situation. After the usual means had been employed to recall him to life, it was agreed that his body should be dissected, to discover the cause of so sudden a death; but the supposed dead person overhearing this proposal, opened his eyes, started up, and immediately betook himself to his heels. Cardinal Espinola, prime minister to Philip II. was not so fortunate; for, in the memoirs of Amelot de la Houssai, we are informed that he put his hand to the knife with which he was opened in order to be embalmed. In short, almost every one knows that Vesalius, the father of anatomy, having been sent for to open the body of a woman subject to hysterics, who was supposed to be dead, he perceived, on making the first incision, that she was still alive; that this circumstance rendered him so odious, that he was obliged to fly; and that he was so much affected by it, that he died soon afterwards. On this occasion we cannot forbear adding an event more recent, but not less melancholy. The Abbé Prevost, so well known by his writings and the singularities of his life, was seized with a fit of apoplexy, in the forest of Chantilly, on the 23d of October 1763. His body was carried to the nearest village, and the officers of justice were proceeding to open it, when a cry which he sent forth terrified all the assistants, and convinced the surgeon that the abbé was not dead; but it was too late to save him, as he had already received a mortal wound.

We shall conclude this article by subjoining, from Dr Hawes's *Address to the Public,* a few of the cases in which this fallacious appearance of death is most likely to happen, together with the respective modes of treatment which he recommends.

In apoplectic and fainting fits, and in those arising from any violent agitation of mind, and also when opium or spirituous liquors have been taken in too great quantity, there is reason to believe that the appearance of death has been frequently mistaken for the reality. In these cases, the means recommended by the *Humane Society for the Recovery of Drowned Persons* should be persevered in for several hours; and bleeding, which in similar circumstances has sometimes proved pernicious, should be used with great caution. In the two latter instances it will be highly expedient, with the view of counteracting the soporific effects of opium and spirits, to convey into the stomach, by a proper tube, a solution of tartar emetic, and by various other means to excite vomiting.

From the number of children carried off by convulsions, and the certainty arising from undoubted facts that some who have in appearance died from that cause have been recovered, there is the greatest reason for concluding, that many, in consequence of this disease, have been prematurely numbered amongst the dead; and that the fond parent, by neglecting the means of recalling life, has often been the guiltless executioner of her own offspring. To prevent the commission of such dreadful mistakes, no child whose life has been apparently extinguished by convulsions should be consigned to the grave till the means of recovery above recommended have been tried, and, if possible, under the direction of some skilful practitioner of medicine, who may vary them as circumstances seem to require.

When fevers arise in weak habits, or when the cure of these has been principally attempted by means of depletion, the consequent debility is often very great, and the patient sometimes sinks into a state which bears so close an affinity to that of death, that there is reason to suspect it has too often deceived the bystanders, and induced them to send for the undertaker when they should have had recourse to the succours of medicine. In such cases, volatiles, *eau de luce*, for example, should be applied to the nose, rubbed on the temples, and sprinkled about the bed; hot flannels, moistened with a strong solution of camphorated spirit, may likewise be applied over the breast, and renewed every quarter of an hour; and, as soon as the patient is able to swallow, a teaspoonful of the strongest cordial should be given every five minutes.

The same methods may also be used with propriety in the small-pox, when the pustules sink, and death apparently ensues; and likewise in any other acute diseases, when the vital functions are suspended from a similar case.

INTERMITTENT or INTERMITTING FEVER, such fevers as go off and soon return again, in opposition to those which are continual.

INTERPOLATION, amongst critics, denotes a spurious passage inserted into the writings of some ancient author.

INTERPOLATION, in the modern algebra, signifies to find an intermediate term of a series, its place in the series being given. This method was first invented by Mr Briggs, and applied by him to the calculation of logarithms.

INTERPOSITION, the situation of a body between two others, so as to hide them, or prevent their action.

The eclipse of the sun is occasioned by an interposition of the moon between the sun and the earth; and that of the moon by the interposition of the earth between the sun and moon.

INTERPRETER, a person who explains the thoughts, words, or writings, of some other. The word *interpres*, according to Isidore, is composed of the preposition *inter*, and *partes*, as signifying a person in the middle between two parties, to make them mutually understand each other's thoughts; whilst others derive it from *inter*, and *præs*, *fidejussor*, that is, a person who serves as security between two others who do not understand each other.

There have been many and keen debates about interpreting Scripture. The Catholics contend that it belongs absolutely to the church; adding, that where she is silent, reason may be consulted, but where she speaks, reason is to be disregarded. The Protestants generally allow reason to be the sovereign judge or interpreter, though some amongst them have a strong regard to synods, and others to the authority of the primitive fathers. Lastly, there are those who have recourse to the spirit within every person to interpret for them, which is what Bochart calls ἀποδειξις του πνευματος.

INTERREGNUM, the time during which the throne is vacant in elective kingdoms; seeing that, in such as are hereditary, like ours, there is no such thing as an interregnum.

INTERREX, the magistrate who governs during an interregnum. This magistrate was established in ancient Rome, and was almost as old as the city itself. After the death of Romulus there was an interregnum of a year, during which the senators were interreges in their turn, five days each.

After the establishment of consuls and of a commonwealth, though there were no kings, yet the name and function of *interrex* was still preserved; for, when the magistrates were absent, or there was any irregularity in their election, or they had abdicated, so that the comitia could not be held, provided they were unwilling to create a dictator, they made an interrex, whose office and authority lasted five days, and after this they appointed another. To the interrex was delegated all the regal and consular authority, and he performed all their functions. He assembled the senate, held comitia or courts, and took care that the election of magistrates was made according to rules. Indeed at first it was not the custom of the interrex to hold comitia, at least we meet with no instance of it in the Roman history. The patricians alone had the right of electing an interrex; but this office fell with the republic, when the emperors made themselves masters of everything.

INTERROGATION, EROTESIS, a figure of rhetoric, in which the passion of the speaker introduces a thing by way of interrogation, to make its truth more conspicuous.

The interrogation is a kind of apostrophe which the speaker makes to himself; and it must be owned that this figure is suited to express most passions and emotions of the mind, and that it serves also to press and bear down an adversary, and generally adds an uncommon briskness, action, force, and variety, to discourse.

INTERROGATION, in *Grammar*, is a point which serves to distinguish those parts of a discourse, where the author speaks as if he were asking questions. Its form is this (?).

INTERSCENDENT, in *Algebra*, is applied to quantities, when the exponents of their powers are radical quantities. Thus, $x^{\sqrt{2}}$, $x^{\sqrt{a}}$, &c. are interscendent quantities.

INTERSECTION, in *Mathematics*, the cutting of one line or plane by another; or the point or line in which two lines or two planes cut each other.

The mutual intersection of two planes is a right line. The centre of a circle is in the intersection of two diameters. The central point of a regular or irregular figure of four sides, is the point of intersection of the two diagonals.

The equinoxes happen when the sun is in the intersections of the equator and ecliptic.

INTERVAL, the distance or space between two extremes, either in time or in place. The word comes from the Latin *intervallum*, which, according to Isidore, signifies the space *inter fossam et murum*, between the ditch and the wall; whilst others observe that the stakes or piles driven into the ground in the ancient Roman bulwarks were called *valla*, and the interstices or vacant spaces between them *intervalla*.

INTERVAL, in *Music*. The distance between any given sound and another, strictly speaking, is not measured by any common standard of extension or duration, but either by immediate sensation, or by computing the difference between the numbers of vibrations produced by two or more sonorous bodies, in the act of sounding, during the same given time. As the vibrations are slower and fewer during the same instant, the sound is proportionally lower or graver; and, on the contrary, as during the same period the vibrations increase in number and velocity, the sounds are proportionally higher or more acute. An interval in music, therefore, is properly the difference between the number of vibrations produced by one sonorous body of a certain magnitude and texture, and of those produced by another of a different magnitude and texture, in the same time.

Intervals are divided into consonant and dissonant. A consonant interval is that whose extremes, or whose highest and lowest sounds, when simultaneously heard, coalesce in the ear, and produce an agreeable sensation called by Lord Kames a *tertium quid*. A dissonant interval, on the contrary, is that whose extremes, simultaneously heard, far from coalescing in the ear, and producing one agreeable sensation, are each of them plainly distinguishable from the other, produce a grating effect upon the sense, and repel each other with an irreconcileable hostility. In proportion as the vibrations of different sonorous bodies, or of the same sonorous body in different modes, more or less frequently coincide during the same given time, the chords are more or less consonant. When these vibrations never coincide at all in the same given time, the discord is consummate, and consequently the interval absolutely dissonant. For a full account of these, see MUSIC.

INTESTATE, in *Law*, a person who dies without making a will.

INTONATION, in *Music*, the action of sounding the notes in the scale with the voice, or any other given order of musical tones. Intonation may either be true or false, too high or too low, too sharp or too flat; and then this word *intonation*, attended with an epithet, must be understood concerning the manner of performing the notes.

In executing an air, to form the sounds, and preserve the intervals as they are marked, with justness and accuracy, is no inconsiderable difficulty, and scarcely practicable, but by the assistance of one common idea, to which, as to their ultimate test, these sounds and intervals must be referred. These common ideas are those of the key, and the mode in which the performer is engaged; and from the word *tone*, which is sometimes used in a sense almost identical with that of the key, the word *intonation* may perhaps be derived. It may also be deduced from the word *diatonic*, as in that scale it is most frequently conversant; a scale which appears most convenient and natural to the voice. We feel more difficulty in our intonation of such intervals as are greater or less than those of the diatonic order; because, in the first case, the *glottis* and vocal organs are modified by gradations too large; or too complex, in the second.

INTRENCHMENT, in the military art, is any work which fortifies a post against the attack of an enemy. It is generally taken for a ditch or trench with a parapet. Intrenchments are sometimes made of fascines with earth thrown over them, or of gabions, hogsheads, or bags filled with earth, to cover the men from the enemy's fire.

INTRIGUE, an assemblage of events or circumstances occurring in an affair, and perplexing the persons concerned in it. In this sense it is used to signify the *nodus* or plot of a play or romance; or that point in which the principal characters are most embarrassed, through the artifice and opposition of certain persons, or the unfortunate falling out of certain accidents and circumstances.

INTRASCA, a city of the kingdom of Sardinia, in the province Pallanza, on Lake Maggiore, containing a nunnery, two churches, 320 houses, and 4570 inhabitants. Here are considerable manufactures of linen goods, hats, glass, and other wares.

INTRINSIC, a term applied to the real and genuine values and properties of any thing, in opposition to their *extrinsic* or *apparent* qualities.

INTRODUCTION, in general, signifies any thing which tends to make another in some measure known, before we have leisure or proceed to examine it thoroughly; and hence it is used on a great variety of occasions. The term is also used to signify the actual motion of any body out of one place into another, when that motion has been occasioned by some other body.

INTUITION, amongst logicians, the act by which the mind perceives the agreement or disagreement of two ideas, immediately by themselves, without the intervention of any other; in which case the mind perceives the truth as the eye does the light, only by being directed towards it. See METAPHYSICS.

INTUITIVE EVIDENCE is that which results from intuition. Dr Campbell distinguishes different sorts of *intuitive* evidence; one resulting purely from intellection, another kind arising from consciousness, and a third sort from that faculty called common sense, which this ingenious writer contends to be a distinct original source of knowledge; but others refer its supposed office to be *intuitive* power of the understanding.

INUNDATION, a sudden overflowing of the dry land by the waters of the ocean, rivers, lakes, springs, or rains.

INVALID, a person wounded, maimed, or disabled for action by age.

INVECTED, in *Heraldry*, denotes a thing fluted or furrowed. See HERALDRY.

INVECTIVE, in *Rhetoric*, differs from reproof, as the latter proceeds from a friend, and is intended for the good of the person reproved; whereas invective is the work of an enemy, and entirely designed to vex and give uneasiness to the person against whom it is directed.

INVENTION denotes the art of finding any thing new, or even the thing thus found. Thus we say, *the invention of gunpowder*, *the invention of printing*, and so on.

INVENTION is also used for the finding of a thing hidden. The Roman Catholic church celebrates a feast on the 4th of May, under the title of the invention of the holy cross.

INVENTION is also used for subtilty of mind, or something peculiar to a man's genius, which leads him to discover things new; in which sense we say, *a man of invention*.

INVENTION, in *Painting*, is the choice which the painter makes of the objects that are to enter into the composition of his piece.

INVENTION, in *Poetry*, is applied to whatever the poet adds to the history of the subject he has chosen, as well as to the new turn he gives it.

INVENTION, in *Rhetoric*, signifies the finding out and choosing of certain arguments which the orator is to use for proving or illustrating his point, moving the passions or conciliating the minds of his hearers. Invention, according to Cicero, is the principal part of oratory; and he wrote four books *De Inventione*, of which we have but two remaining.

INVERARY, a royal burgh of Scotland, and capital of the county of Argyle. It is delightfully situated on the west bank of Loch Fine, near its upper extremity, at the distance of 102 miles west by north of Edinburgh, 60 north-west from Glasgow, and thirty to the south-east of Oban. In front of the town is the small bay of Loch Fine, environed by romantic and woody hills; whilst, on its north side, with extensive and beautiful pleasure-grounds, stands the castle of Inverary, the seat of the ducal house of Argyle. Behind this spacious mansion the river Ary joins the loch, and from its margin rises the pyramidal hill of Duinicoich, to an elevation of seven hundred feet, embellished and wooded to the summit. The town of Inverary is small, consisting principally of a line of houses facing the lake. The town originally stood on the north side of the bay, but was removed by the proprietor to its present site. Within these few years several elegant residences have been erected, and the houses are generally well built. The town possesses a very comfortable modern church, a jail and court-house, with a parish, grammar, and charity school; the two latter being supported by the Argyle family. The herring fishery is the chief trade carried on here; and for the convenience of maritime traffic there is a well-built quay, which projects so far into the bay as to admit of vessels of considerable burden loading and unloading at low water. Inverary was an early seat of the Argyle family, under whose influence it was created a royal burgh by Charles I. in 1648, during his residence at Caresbrook Castle. By this arrangement its civic government consists of a provost, two bailies, a dean of guild, a treasurer, and a council appointed by the duke. The revenue arises from the petty customs, the rent of a common, and an annuity of L.20 conferred upon it by Duke Archibald. The castle is the principal object of attraction in this part of the county. It is a square edifice, built to replace one of more ancient date, and is constructed with a tower at each corner. The scenery around this elegant mansion attracts universal admiration, and the decorations of the interior of the building are of corresponding splendour. The collection of old Highland armour which is to be found within the saloon, is particularly worthy of attention. No less than L.30,000 are said to have been expended in building, planting, improving, making roads, and in other works or utility and decoration in and around the castle. During summer Inverary is resorted to by an immense number of travellers. It can be approached from Glasgow by three routes, all of which are more or less calculated to delight the lover of the sublime or beautiful in nature. First, there are steam-boats which sail down the Clyde, touching at Greenock and Rothesay, then through the tortuous and beautiful strait called the Kyles of Bute, and finally up the long arm of the sea called Loch Fine, near the head of which Inverary is situated. The second route is more direct, and occupies only about one half the time of the former. After passing down the Clyde, a small arm of the sea called Holy Loch is entered; and the traveller, after disembarking at the small village of Kilmun, crosses a wild vale of a few miles in length, and then enters upon the beautiful inland lake called Loch Eck, at the top of which he is transferred over land to the shores of Loeh Fine. The third route involves the famous scenery of Loch Lomond and Glencoe, and is somewhat more circuitous than that just mentioned. By all these routes, scenery combining the grand with the beautiful is opened up to the eye of the tourist. The population of the town and parish amounted in 1821 to 1137, and in 1831 to 2133.

INVERBERVIE, or Bervie, a town of Scotland, in Kincardineshire, and a royal burgh in virtue of a charter of David II. dated 1362, and renewed by James VI. in 1595. It is situated on the sea-coast, at the mouth of a stream called Bervie, between two small hills, which terminate in high cliffs towards the sea, at thirteen miles distance north-east from Montrose. The first machine for spinning flax in Scotland was erected at Bervie, which still carries on this manufacture to an inconsiderable extent. It unites with Montrose, Arbroath, Brechin, and Forfar, in returning a member to parliament. In 1831 the population amounted to 1137.

INVERKEITHING, a royal burgh of Scotland, in the county of Fife, is agreeably situated in a bay called St Margaret's Hope, on the north shores of the Frith of Forth, at the distance of thirteen miles from Kirkaldy, twenty-eight from Stirling, four from Dunfermline, and about fourteen from Edinburgh. It stands on the brow of an acclivity which rises from the margin of the bay, and consists of one main street of considerable length, with diverging lines and thoroughfares, and a number of houses erected in the neighbourhood of the harbour. Inverkeithing is a town of very considerable antiquity. The first existing grant which it possesses is one from William the Lion, confirming one of an earlier but unknown date, by which grant the burgh was endowed with a jurisdiction over the adjacent county to an extent of at least twenty miles each way. Within these limits the civic authorities possessed considerable powers and privileges, some of which remain to this day. James VI. confirmed the writ of the burgh in 1598. The civic government is exercised by a provost and high sheriff, two bailies, a dean of guild, and treasurer, annually elected by the councillors and deacons of the trades. This town, in times of remote antiquity, is said to have been the residence of many noble families; and David I. is known to have had a minor palace here. An old antique tenement is also pointed out as having been the abode of Queen Annabella Drummond, the consort of Robert III. and mother of the first James. Before Edinburgh obtained the honour, Inverkeithing was the place where the convention of royal burghs was regularly held. The burgh possesses a neat town-house, containing a jail with apartments for courts. Besides the established church, which is an elegant modern building, there is an United Associate Synod meeting-house. There is a public grammar-school, with other private seminaries of education. No manufactures are carried on in the town, but in the neighbourhood there is an extensive distillery, a magnesia work, and some salt-pans. The chief trade of the place consists in the shipment of coal, of which article large quantities are here embarked. Railways have been laid between the coal-pits and the harbour. The port of Inverkeithing is, by authority, a place where vessels ride quarantine; and here government has stationed a body of officers, with a lazaretto, on shore. In 1821 the population amounted to about 1400, and in 1831 to 3189.

INVERLOCHY, or Innerlochy, a place in the West Highlands of Scotland, in the county of Inverness. It is situated on the east shore of Loch Eil, near the spot where that arm of the sea is joined by the Caledonian Canal. The town of Fort William lies contiguous to it on the south. According to legendary lore, this place is declared to be the site of a city once the greatest in Scotland, and that here King Achaius signed a treaty with Charlemagne. The remains of the ancient pavement of streets are ostentatiously pointed to as corroborating these fanciful conjectures; but if ever a town existed here, many ages have elapsed since the last vestige of it disappeared, and nothing now remains but a huge quadrangular edifice, styled Inverlochy Castle, which towers in solitary magnificence, and has survived all tradition respecting its origin. The building forms a court, and is provided at the angles with round towers, of the most massive proportions, the whole fabric covering a space of 1600 yards. Inverlochy gives its name to one of the most brilliant victories of the Marquis of Montrose, which he gained in February 1645.

INVERNESS, the only large town in the county, and usually styled the capital of the Highlands, is finely situated on the banks of the river Ness, where it falls into the Moray Frith. The ancient and principal part of the town is on the east side of the river; but, since the construction of the Caledonian Canal, houses and streets are extending towards the west. Some writers have invested Inverness with a fabulous antiquity. It is certain that it was one of the Pictish capitals, was early incorporated as a free town, and received four charters from William the Lion. In 1412, Inverness was burned by Donald, Lord of the Isles, on his march to the battle of Harlaw. A castle stood to the east of the town, in which Macbeth is said to have murdered King Duncan. This fortress was razed to the ground by Malcolm Ceanmore, and another built on an eminence by the river side, which continued as a royal fortress till blown up by the troops of the Pretender in 1746. This hill is now the site of a beautiful castellated structure, containing the court-house, county-rooms, and record office, built in 1835. In the centre of the burgh is the town-hall, erected in 1708, in front of which is placed the ancient cross of the burgh, and a large circular stone, or collection of stones, bound round with iron hoops, called *Clach-na-cuden*, or Stone of the Tubs, on which the servants used to rest their pails in carrying water from the river. At the northern extremity of the town are the remains of a fort built by Oliver Cromwell, capable of accommodating 1000 men. The site of this erection, part of the ramparts of which still remain, has been converted into a manufactory for thread and sacks. There are two bridges over the river Ness, one a handsome stone bridge of seven arches, built by public subscription in 1685, and the other a strong wooden bridge, erected about twenty years ago. In 1826, gas was introduced for lighting the town; and in 1830, the supplying it with water, conveyed in pipes from the river, was carried into effect. In 1831 the streets of

Inverness-shire.

Inverness were paved anew with granite, and common sewers made, the whole costing about L.6000. The jail, which is small and inconvenient, was built in 1791, at an expense of L.1800, and is ornamented with a fine spire, which cost L.1600 more. There are two churches belonging to the establishment, one for English and the other for Gaelic, which is still spoken by the lower class of the inhabitants, especially in the country. It is in contemplation to erect a new church, for which large subscriptions have been received. A handsome Catholic chapel was erected in 1835. There is a neat Episcopalian chapel, and places of worship for the Seceders, the Independents, and Methodists. Inverness has also a royal academy, at which about 250 pupils attend. Races were formerly held here, but they have been discontinued for several years. There are assembly rooms, elegantly fitted up. There are four banking establishments in Inverness, two weekly newspapers, and two public reading-rooms. No town has improved so rapidly in the arts and embellishments of social life; but its admirable situation for trade has not been sufficiently improved. The steam-boats between Inverness and Glasgow have increased the traffic in this direction; and were a woollen manufactory, or other undertaking of a similar nature, established, the Caledonian Canal and the Moray Frith, affording an unlimited command of water-power in every direction, might be turned to great advantage. The population of the town and parish in 1831 amounted to 14,324, that of the town alone being 9663. Of the present population, 529 families are chiefly engaged in agriculture, 1015 families employed in trade, and 1766 not included in either of these classes.

INVERNESS-SHIRE, the most extensive county in Scotland, situated between 56° 40′ and 57° 36′ north latitude, and between 3° 50′ and 5° 50′ west longitude from Greenwich, is bounded on the north by the shires of Ross and Cromarty; on the east by those of Aberdeen, Banff, Moray, and Nairn, and by the Moray Frith; on the south by the counties of Perth and Argyle; and on the west by the Atlantic Ocean. It is from fifty to seventy-five miles in length; in breadth from thirty to fifty miles; and its area is computed at 3036 square miles, of which the space occupied by lakes has been estimated at 132 miles, and the land at 2904, or 1,858,560 English acres.

The exterior outline of this county is exceedingly irregular. On the north-east, where the county town is situated, a narrow tract runs out between Nairnshire and the Moray Frith. Farther to the east, a portion of it is detached and enclosed by the counties of Moray and Banff; Argyleshire penetrates into it from the south-west; and on the west it is indented by Lochs Moidart, Aylort, Nevis, Hourn, and other arms of the sea.

The surface is still more varied, consisting of ranges of lofty mountains, alternating with deep narrow valleys, the beds of a great many lakes and rivers. The most prominent feature is Glenmore, or the Great Glen, for the most part a mile in breadth, and bounded on either side by precipitous high grounds, which traverses the county from south-west to north-east, dividing it into two nearly equal parts. In this glen, from north to south, are Loch Ness, Loch Oich, and Loch Lochy, which, being united by the Caledonian Canal, form a line of inland navigation between the east and west seas, or from the Moray Frith on the north-east, to Linnhe Loch, an arm of the Atlantic, on the south-west, a distance of about sixty miles, for frigates of thirty-two guns, and vessels of 600 tons. Loch Ness is remarkable for never freezing, a circumstance ascribed to its great depth; and for its waters having been violently agitated during the great earthquake at Lisbon in November 1755. On each side of this valley there is a number of glens and straths, separated by mountainous ridges, with lakes which receive the waters from the high grounds, and discharge them by outlets, partly into the lakes in the central valley, and partly, by a more direct course, into the arms of the Atlantic on the west, or by rivers which flow from this county into the counties on the east, and thence into the German Ocean.

The western side, or the country between the great valley and the Atlantic, from Argyleshire on the south to Ross-shire on the north, a distance of about seventy miles, is the most wild and mountainous tract of Inverness-shire, and is therefore known by the name of the *Rough Bounds;* yet, before reaching the sea-coast, the general elevation is somewhat diminished. In this tract, beginning at the south, the principal divisions are, Moidart, Arasaig, Morar, Knoidart, and Glenelg, which contain a variety of glens or valleys, among which are, Glengarry, Glen Moriston, Glen Urquhart, and Strathglass. The most considerable lakes in this quarter are, Loch Eil, Loch Shiel, Loch Arkaig, Loch Garry, and Loch Maddy. Lochan Uain, in the parish of Kilmorack, about forty miles west from Beauly, is said to have been known to remain frozen all the year through. On the east side of the valley lies the extensive district of Badenoch; at its southern termination is Lochaber; and at its northern the Aird, the most fertile part of the county. These divisions also include a great many glens, lakes, and rivers, extensive woodlands, and not a little productive land. The principal valleys here are Glenroy, noted for its parallel roads, which, it is now agreed, must have been formed by the gradual subsidence of the waters, and not by the hand of man; Strathspey, Stratherrick, Strathearn, and Strathnairn. Treig, Ericht partly in Perthshire, Laggan, Insch, and Moy, are the names of the most considerable of the lochs in this quarter; and here the Spey, the Findhorn, and the Nairn, and a number of smaller streams, have their source.

The general aspect of Inverness-shire may be further conceived, when it is stated that two thirds of the surface are covered with heath; that only a fortieth part is corn land; and that the corn land, woodlands, and green pastures, together, do not exceed eight acres in an hundred. In many large tracts heath prevails to such a degree that, for twelve or fourteen miles, scarcely any verdure is to be seen, except where a solitary rivulet has occasionally overflowed its banks. On the south of Badenoch there is a flat of deep moss, supposed to be the most extensive in Britain, in which a great number of small lakes are interspersed, some of them containing wooded isles, where the deer, from the inaccessible nature of the ground, find shelter from their pursuers. But the far greater part of the county is occupied with mountains. Ben Nevis, 4380 feet high, stands on the south-west, a little to the east of the Caledonian Canal; Meal Fourvounie, on the west of Loch Ness, is more than 3000 feet high; and Cairngorm, partly in Banffshire, upwards of 4000. It has been remarked, as a singular circumstance, that several of the hills, which are covered with heath on the sides, are green on the summit, and produce valuable pasturage. The productive land lies chiefly on the sea-coast, and along the banks of the lakes and rivers; much of it in the latter situation is alluvial and fertile. There is also clay in a few places; but the prevailing soil is sand, or a sandy loam, well adapted to the growth of barley, potatoes, turnips, and other green crops.

The principal rivers of Inverness-shire are, the Spey, which rises from a loch of that name, a little to the east of the Great Valley, and, flowing in a course from south-west to north-east for about ninety-six miles, falls into the sea about eight miles east of Elgin, in Morayshire, carrying with it the waters of 1300 square miles; the Ness, which issues from Loch Ness, and, flowing through the town of Inverness, falls into the Moray Frith, after a course of six miles; the Lochy issues from Loch Lochy, and has a course of ten miles westward, till it falls into Loch Eil near Fort William; soon after it leaves its parent lake, it is joined, from the east, by the Spean, which is remarkable for being crossed by a bridge, two of the arches of which are ninety-five feet high; and the Beauly, which has its source in the north-west, and carries the united waters of the Glass and other two rivulets into the frith of the same name. The Findhorn and Nairn on the east, and the Garry and the Morriston on the west, are smaller streams. The Foyers, which flows into Loch Ness from the south, is remarkable for its celebrated falls, one of which, according to Dr Garnet, is seventy feet, and the other, half a mile lower, 212 feet. There are cascades not inferior to these in the parish of Kilmorack, on the waters which unite to form the Beauly, and at Loch Leven head in the southern quarter; near which last place there are also some remarkable caverns.

Granite, limestone, slate, marble, brick-clay, abound in many parts of Inverness-shire. Lead has been discovered in Ben Nevis, and at three other places in that neighbourhood, and also at Glengarry, but none of it is wrought. A vein of plumbago has also been found at Glengarry. A great part of the mountain of Ben Nevis is composed of beautiful porphyry. There is no coal, and for want of it much of the limestone is of little value.

From the trees found in great numbers, and some of them of a remarkable size, in all the mosses, there is reason to believe that this country was, at an early period, almost covered with wood; and at present there is a greater space covered with natural pines here than in all the rest of Britain. In Strathspey it is said that three tiers of stocks have been found, directly above one another, in a moss; from which it is inferred that the deepest must have come to maturity, and been destroyed, before the one next above it was formed. In the same district there are about 15,000 acres of natural firs, besides 7000 of planted firs and larches; and the natural woods on Loch Arkaig, in Glengarry, Glenmoriston, Strathglass, Strathfarrer, and at the head of Loch Shiel, are also very extensive. Full-grown trees of ash, lime, beech, oak, plane, and mountain-ash, are found at Castle Grant, Culloden, and Belladrum, in the northern quarter of the county; but in most other places the woods are in the state of coppice. The birch is in great abundance on the sides of Loch Ness, Loch Laggan, about Rothiemurchus, and in the vale of Urquhart. Part of the great Caledonian Forest extends for several miles near the boundary of this county with Perthshire. Considerable tracts have been planted, chiefly with firs and larches, particularly in the north-east, where the county town is situated, in Badenoch, and on Loch Eil.

There are several fishing villages on the east coast, yet the sea-fishery is not prosecuted to a great extent. But the arms of the sea, and the numerous lakes and rivers, afford an abundant supply of fish. The herring occasionally visits Loch Eil; salmon yield a considerable rent on the rivers Lochy, Beauly, and Ness, and are found also in the Morrer, in Loch Insch in Badenoch, and at Invermoriston. Char is caught in several of the lochs, and flounders and sprats in the Beauly. The moors and woodlands are plentifully stocked with game, viz. red and roe deer, the Alpine and common hare, black game and ptarmigan, grouse, partridges, &c.; and pheasants have lately been introduced. Foxes and wild cats are still numerous, and, in the lakes and rivers, otters. There are also eagles, hawks, and owls; and a multitude of water fowls, particularly swans, resort to Loch Insch, and the other lakes of Badenoch.

The territory of Inverness-shire is divided into estates of great extent, and, in proportion to the rental of the county, of great value. In 1804 more than the half, if we may judge from the old valuation, belonged to seven proprietors, and as much more was held by other six, as made the possessions of these thirteen individuals equal to more than two thirds of the whole; each of them, at a medium, must, therefore, have contained about 100,000 acres. There are thirty-nine estates valued at above L.500, and thirty-five estates below L.500 and above L.100. The greatest landed proprietors are Lord Macdonald, the Earl of Seafield, Mr Fraser of Lovat, Mackintosh of Mackintosh, Macleod of Macleod, Macdonell of Glengarry, Colonel Cameron of Lochiel, Lord Glenelg, the Earl of Moray, Chisholm of Chisholm, Colonel Macniel of Barra, Lord Dunmore, Mr Grant of Ballindalloch, Mr Stewart of Belladrum, Mr Baillie of Lochaber, Mr Grant of Glenmoriston, &c. The valuation taken in 1601 was L.73,188. 9s. Scots, and in 1811 the real rent of the lands was L.195,843. 15s. sterling, and of the houses, L.9235. 2s. sterling. The valuation taken in 1814 was L.152,078. 12s. 2½d.; but this sum is nothing like the real rent, being made merely for collecting the property tax. There are several estates of very considerable income, though not of great extent, such as Muirtown, Insches, Culduthell, and others. The old valuation of the whole of Scotland, as fixed about the middle of last century, and which is still the rule by which county assessments are imposed, is to the actual rent of the lands alone in 1811, as L.1 Scots is to L.1.263 sterling; whereas in this county, rents have risen in so much greater a proportion than in the rest of Scotland, chiefly perhaps owing to the introduction of sheep-farming, that its valuation is to its actual rent only as L.1 Scots is to L.2.675 sterling; and it is worthy of remark, that this rise cannot be ascribed in any considerable degree to the outlay of capital by proprietors, in building or otherwise, as in most other parts of Scotland.

Of the occupiers of the land, tacksmen, small tenants, and cottars, of the size of the farms, and the rural economy of the county generally, we have little to say in addition to what we have already offered under the Highland counties of Scotland in the preceding part of this work. Small spots of corn-land contiguous to the hamlets, of which the alternate ridges or lands belong to different cultivators, who used to interchange their allotments once a year, and more recently only once in three years; a larger space of *outfield* beyond this, part of which is constantly cropped till it is exhausted, and then left to nature, when another part, which had been treated in the same manner, but which has been somewhat restored in the mean while by the folding of cattle, takes its place; and beyond this outfield, separated from the higher grounds by a *head dike*, large tracts of common pasture; these, with their miserable huts, their irregular and always inefficient labour, their indolence, and their poverty, present a striking picture of what must have been the condition of the great body of the people of Scotland during the feudal ages; but it is not now, as it was then, somewhat relieved by hospitality and protection on the one side, and respect, gratitude, and attachment, on the other.

This system, indeed, has been gradually approaching to its termination during the last thirty years, and in some parts of Inverness-shire it exists no longer in its original form. The change has been chiefly effected by the introduction of sheep, which has occasioned many complaints, and probably much real suffering for a time to many individuals, but which is likely in the end to be most advantageous to the public at large. With respect to its effect on population, one main topic of declamation, it has not been such as its opponents allege; for the population of Inverness-shire, any more than of the Highlands in general, has not diminished. On the contrary, its increase in this county, from 1755 to 1811, has been much greater than in

Inverness-shire.

Haddingtonshire and the other merely agricultural districts of Scotland. Within that period, it has increased from 64,656 to 78,336, or upwards of twenty-one per cent., whilst that of all Scotland has not been more than forty-four per cent.; and it is well known that the far greater part of this apparently general increase has been occasioned by the extension of manufactures and commerce, and is chiefly confined to a few districts.

The principal exports are cattle, sheep, wool, timber, and slates. The corn grown in the county, chiefly bear or big, and oats, and only on the east coast wheat, is all consumed within itself, much of the bear in illicit distillation; as well as all the potatoes, the most important article of food for the greater part of the year; and the products of the dairy. It imports coals, lime, flour, oatmeal, groceries, and other articles of domestic consumption. The manufactures are, bagging from hemp, thread, kelp to a considerable extent on the west coast, with some tiles and bricks. There are also tan-works, breweries, bleachfields, and an iron-foundery; and some attempts have been made at different periods to carry on branches of the woollen manufacture.

From the west sea a few vessels come up to Fort William, from which the exports are wool, skins, herrings, kelp, and slates. The most considerable village is Maryburgh, or Gordonsburgh, near Fort William. Grantown is a neatly built village on the great road along the Spey, and, under the auspices of Sir James Grant, the proprietor, it has made considerable progress. It contains a town-house and prison, with a well-endowed school; and a few years ago a factory was begun for carding and spinning wool, and for making blankets and woollen cloths. Fairs are held for the sale of cattle, sheep, and wool, at Fort William, Beauly, Grantown, and Kingussie, and four in the year in Inverness, where there is also a well-supplied market every Tuesday and Friday. Some years back an easy communication was formed throughout the greater part of the county, by means of the roads made under the direction of theParliamentary Commissioners for Highland Roads and Bridges, half the expense of which is borne by the county, and the other half is granted by parliament.

Amongst the antiquities of Inverness-shire, which we can only notice generally, are the circles of stones ascribed to the Druids, which are found in many parts of the county, particularly at Corrimony in its northern quarter; two artificial mounts in the parish of Petty, supposed to have been places for administering justice; round buildings, called Picts' Houses, in Glenelg, and other parts; forts, built without mortar, one of which, called Castle Spynie, two miles east from the church of Beauly, encloses a circle of fifty-four yards, and another, in the parish of Laggan, stands on a rock, a hundred yards in perpendicular height; vitrified forts on the hill of Craig Phadric, about two miles from Inverness, Dundhairdghall in Glen Nevis, and Dun Thion near the river Beauly; and a variety of castles, of which Inverlochy Castle, a building of great extent and unknown antiquity, on the banks of the Lochy, near Fort William, is, perhaps, the most remarkable. On a hill near Inverness, called the Castle Hill, stood the castle of the Thane of Cawdor, where Macbeth is said to have murdered Duncan. It was razed by Malcolm Ceanmore, who removed the town to the northward, where it now stands, granted its first charter, and built a fortress on the site of the old town, which was repaired in 1715, and finally demolished in 1765. Cromwell erected a citadel at the mouth of the river Ness, which was demolished by Charles II.

There is a chain of forts stretching across the island, along the line of the Caledonian Canal. Fort George is a regular fortress, mounting eighty guns, with barracks for 3000 men; it was begun in 1747, and completed in twenty years, at an expense of about L.160,000. It is situated eleven miles eastward from Inverness, upon a neck of land on the Moray Frith, opposite to Fortrose in Ross-shire. Fort Augustus, also a regular fortification, though a place of no great strength, with four bastions, and barracks for 400 men, is situated at the west end of Loch Ness, nearly midway between the east and west seas. It was first built in 1730, at some distance from Loch Ness; but having been demolished by the rebels in 1745, it was afterwards rebuilt nearer the lake. Fort William, built in the reign of William III., is situated on a navigable arm of the sea, called Loch Eil, at the south-western termination of the great valley. These forts are now useless in a military point of view, though kept in a state of good repair, and answering as barracks for a few soldiers. On Culloden Moor, a level heath to the eastward of Inverness, on the 16th April 1746, was fought the battle which put an end to the rebellion of 1745; the greater part of this heath is now covered with plantations.

Inverness-shire contains twenty-eight entire parishes, and shares several others with the counties of Argyle, Nairn, and Moray. Of these, twenty are on the mainland, and the remainder in its islands. Some of the parishes on the mainland, as well as in the islands, would form a square of twenty miles each. Kilmalie and Kilmorack are still larger, extending in length about sixty miles, and in breadth almost thirty. Many of the inhabitants are Roman Catholics, particularly in the districts of Moidart, Arasaig, Morar, and Knoidart, on the west side. The county sends one member to parliament, and the town of Inverness, along with Forres, Nairn, and Fortrose, choose one for the burghs. The sheriff holds courts at four places, two of which, Inverness and Fort William, are for the mainland, and two more for the isles in Skye and Long Island. The population of the whole shire in 1811, 1821, and 1831, is given in the annexed table. (See the *Statistical Account of Scotland;* Playfair's *Description of Scotland;* Robertson's *Survey of Inverness-shire; The Beauties of Scotland*, vol. v.; and the *General Report of Scotland.*)

YEAR.	HOUSES.			OCCUPATIONS.			PERSONS.		
	Inhabited.	By how many Families occupied.	Uninhabited.	Families chiefly employed in Agriculture.	Families chiefly employed in Trade, Manufactures, or Handicraft.	All other Families not comprised in the two preceding classes.	Males.	Females.	Total of Persons.
1811	14,646	16,014	215	9,594	3294	3126	35,722	42,614	78,336
1821	17,055	18,324	413	10,215	2447	5662	42,304	47,853	90,157
1831	17,312	19,046	440	9,892	2753	6401	44,510	50,287	94,797

INVERSE, the opposite of direct, is applied to a particular form of proportion. See ARITHMETIC.

INVERSION, the act by which any thing is inverted or turned backwards. Problems in geometry and arithmetic are often proved by inversion; that is, by a contrary rule or operation.

INVERSION, in *Grammar*, is where the words of a phrase are ranged in a manner not so natural as they might be. For instance, "Of all vices, the most abominable, and that which least becomes a man, is impurity." Here is an inversion, the natural order being, "Impurity is the most abominable of all vices, and that which least becomes a man." An inversion is not always disagreeable, but sometimes has a good effect.

INVERTED, in *Music*, signifies a change in the order of the notes which form a chord, or in the parts that compose harmony, which happens by substituting in the bass, those sounds which ought to have been in the upper part; an operation not only rendered practicable, but greatly facilitated, by the resemblance which one note has to another in different octaves. Hence we derive the power of exchanging one octave for another, or substituting in the extremes those which ought to have occupied the middle station, and *vice versa*.

INVERURY, a royal burgh of Scotland, in the county of Aberdeen, and capital of a parish of the same name. It is pleasantly situated in the angle of land near the confluence of the Urie and Don, at the distance of sixteen miles north-west of Aberdeen. The oldest charter is a *novodamus* by Queen Mary, narrating that Inverury had been a royal burgh from time immemorial, but that the charter had been lost during the civil wars. Tradition relates that it was granted by Robert Bruce, after he had gained a battle over the English at this place, the first of that series of victories by which that monarch achieved the independence of his country. The town is small, and its trade is only in manufactures for local use. Besides the parish church, there are two dissenting meeting-houses. The population of the burgh and parish amounted in 1821 to 1129, and in 1831 to 1419.

INVESTIGATION properly denotes the searching or finding out any thing by the tracts or prints of the feet; and hence mathematicians, schoolmen, and grammarians, have employed the term in their respective researches.

INVESTITURE, in *Law*, a giving livery of seisin or possession. There was anciently a great variety of ceremonies used upon investitures, which at first were made by a certain form of words, and afterwards by such things as had the greatest resemblance to the thing to be transferred. Thus, where lands were intended to pass, a turf was delivered by the granter to the grantee. In the church, it was customary for princes to make investiture of ecclesiastical benefices, by delivering to the person they had chosen a pastoral staff and a ring.

INVOCATION, in *Theology*, the act of adoring God, and especially of addressing him in prayer for his assistance and protection.

The difference between the invocation of God and of the saints, as practised by the Roman Catholics, is thus explained in the catechism of the council of Trent. "We beg of God," says the catechism, "to give us good things, and to deliver us from evil; but we pray to the saints to intercede with God and obtain those things which we stand in need of. Hence we use different forms in praying to God and to the saints; to the former we say, *hear us, have mercy on us;* to the latter we only say, *pray for us.*" The council of Trent expressly teaches that the saints who reign with Jesus Christ offer up their prayers to God for men, and condemns those who maintain the contrary doctrine. The Protestants reject and censure this practice as contrary to Scripture, deny the truth of the fact, and think it highly unreasonable to suppose that a limited finite being should be in a manner omnipresent, and at one and the same time hear and attend to the prayers which are offered to him in England, China, and Peru; and hence they infer, that if the saints cannot hear their requests, it is inconsistent with common sense to address any kind of prayer to them.

INVOCATION, in *Poetry*, an address at the beginning of a poem, in which the poet calls for the assistance of some divinity, particularly of his muse, or the deity of poetry.

INVOICE, an account, in writing, of the particulars of merchandise, with the value, customs, charges, &c. thereof, transmitted by one merchant to another in a distant country.

INVOLUCRUM, amongst botanists, expresses that sort of cup which surrounds a number of flowers, every one of which has, besides this general cup, its own particular perianthium. The *involucrum* consists of a multitude of little leaves disposed in a radiated manner.

INVOLUTION, in *Algebra*, the raising any quantity from its root to any height or power assigned. See ALGEBRA.

IO, in fabulous history, daughter of Inachus, or, according to others, of Jasus or Pirene, was priestess of Juno at Argos. Jupiter became enamoured of her; but Juno, jealous of his intrigues, discovered the object of his affection, and surprised him in the company of Io. Jupiter changed his mistress into a beautiful heifer; and the goddess, who well knew the fraud, obtained from her husband the animal whose beauty she had condescended to commend. Juno commanded the hundred-eyed Argus to watch the heifer; but Jupiter, anxious for the situation of Io, sent Mercury to destroy Argus, and to restore her to liberty. Io, freed from the vigilance of Argus, was now persecuted by Juno, who sent one of the Furies to torment her. She wandered over the greater part of the earth, and crossed the sea, till at last she stopped on the banks of the Nile, still exposed to the unceasing torments of the Fury. Here she entreated Jupiter to restore her to her natural form; and when the god had changed her from a heifer into a woman, she brought forth Epaphus. Afterwards she married Telegonus, king of Egypt, or Osiris according to others; and she treated her subjects with such mildness and humanity, that after death she received divine honours, and was worshipped under the name of Isis. According to Herodotus, Io was carried away by Phœnician merchants, who wished to make reprisals for Europa, who had been stolen from them by the Greeks.

IOLAIA, a festival at Thebes, the same as that called *Heracleia*. It was instituted in honour of Hercules and his friend Iolas, who assisted him in conquering the hydra. It continued during several days, on the first of which were offered solemn sacrifices; the next day horse-races and athletic exercises were exhibited; the following day was set apart for wrestling; and the victors were crowned with garlands of myrtle generally used at funeral solemnities. But they were sometimes rewarded with tripods of brass. The place where the exercises were exhibited was called *Iolaion*, where were to be seen the monument of Amphitryon and the cenotaph of Iolas, who was buried in Sardinia. These monuments were covered with garlands and flowers on the day of the festival.

IOLAS, or IOLAUS, in *Fabulous History*, a son of Iphiclus, king of Thessaly, who assisted Hercules in conquering the hydra, and burned with a hot iron the place where the heads had been cut off, to prevent the growth of others. He was restored to youth and vigour by Hebe, at the request of his friend Hercules. Some time afterwards Iolas assisted the Heracleidæ against Eurystheus, and killed the tyrant with his own hand. According to Plutarch, Iolas had a monument in Bœotia and Phocis, where lovers used to go and bind themselves by the most solemn oaths of fidelity, considering the place as sacred to love and friendship. According to Diodorus and Pausanias, Iolas died and was buried in Sardinia, where he had gone to make a settlement at the head of the sons of Hercules by the fifty daughters of Thespius.

ION, in fabulous history, a son of Xuthus, and Creüsa, daughter of Erechtheus, who married Helice, the daughter of Selinus king of Ægiale. He succeeded to the throne of his father-in-law, and built a city, which he called *Helice*, on account of his wife. His subjects received from him the name of *Ionians*, and the country that of *Ionia*. See Ionia.

Ion, a tragic poet of Chios, who flourished about the eighty-second Olympiad. His tragedies were represented at Athens, where they met with universal applause. He is mentioned and greatly commended by Aristophanes, Athenæus, and others.

IONA, or Icolmkill, one of the Hebrides, a small but celebrated island, "once," as Dr Johnson expresses it, "the luminary of the Caledonian regions, whence savage clans and roving barbarians derived the benefits of knowledge and the blessings of religion." The name *Iona* is derived from the Hebrew word signifying a *dove*, in allusion to Columba, who landed here in 565. It is said to have been a seat of the Druids before his arrival, when its name in Irish was *Inis Drunish*, or the Druid Island. The Druids being expelled or converted, Columba founded here a cell of canons regular, who, till 716, differed from the church of Rome in the observance of Easter and in the tonsure. After his death the island retained his name, and was called *Ycolumb cill* or Columb's cell, now *Icolmkill*. The Danes dislodged the monks in the seventh century, and the Cluniacs were the next order who settled here.

This island, which belongs to the parish of Ross, in Mull, is three miles long and one broad. The east side is mostly flat, the middle rises into small hills, the west side is very rude and rocky, and the whole forms a singular mixture of rock and fertility. There is in the whole island only one village, or rather collection of huts, inhabited by a population of about 450 individuals, for whose education and religious improvement a church and schoolhouse have been erected by the Society for the Diffusion of Christian Knowledge. Near the town is the bay of the martyrs who were put to death by the Danes. An oblong enclosure, bounded by a stone dyke, and called *Clach-nan-Druinach*, in which bones have been found, is supposed to have been a burial-place of the Druids, or rather the common cemetery of the town's people. Beyond the town are the ruins of the nunnery of Austin canonesses, dedicated to St Oran, and said to have been founded by Columba. The church was fifty-eight feet by twenty, and the eastern roof is entire. On the floor, covered deep with cow-dung, is the tomb of the last prioress, with her figure praying to the Virgin Mary, and this inscription on the ledge: *Hic jacet domina Anna Donaldi Ferleti filia, quondam prioressa de Jona, quæ obiit an'o m° d° xi^mo ejus animam Altissimo commendamus*; and another inscribed, *Hic Jacet Mariota filia Johan. Lauchlain domini de....* A broad paved way leads hence to the cathedral; and on this way there is a large handsome cross called Macleane's, the only one that remains of three hundred and sixty which were demolished here at the Reformation. Reilig Ouran, or the burying-place of Oran, is the large enclosure where the kings of Scotland, Ireland, and of the isles, with their descendants, were buried, in three several chapels. The dean of the isles, who travelled in 1549, and whose account has been copied by Buchanan, says, that in his time, on one of these chapels, or "tombes of stain formit like little chapels, with ane braid gray marble or quhin stain on the gavil of ilk ane of the tombes," containing, as the chronicle says, the remains of forty-eight Scotch monarchs, from Fergus II. to Macbeth, sixteen of whom were pretended to be of the race of Alpin, was inscribed *Tumulus regum Scotiæ*; the next was inscribed *Tumulus regum Hiberniæ*, and contained four Irish monarchs; and the third, inscribed *Tumulus regum Norwegiæ*, contained eight Norwegian princes, or viceroys of the Hebrides, whilst these islands were subject to the crown of Norway. Boecius says, that Fergus founded this abbey to serve as a burial-place for his successors, and caused an office to be composed for the funeral ceremony. All that Mr Pennant discovered here, consisted in certain slight remains, built in a rigid form, and arched within, but the inscriptions were lost. These were called *Jornaire nan righ*, or "the ridge of the kings." Amongst those stones are to be seen only two inscriptions, in the Gaelic or Erse language, but written in the ancient Irish characters: *Cros Domhail fat'asich*, "the cross of Donald Longshanks," and that of *Urchvine o Guin*; and another inscribed *Hic jacet priores de Hy, Johannes, Hugenius, Patricius, in decretis olim baccalaureus, qui obiit an. Dom. milles^mo quingentesimo.* About three hundred inscriptions were collected here by Mr Sacheverel in 1688, and given to the Earl of Argyll, but afterwards lost in the troubles of the family. The place is in a manner filled with grave-stones, but so overgrown with weeds that few or none are at present to be seen, far less can any inscriptions be read. Here also stands the chapel of St Oran, the first building commenced by Columba, which the evil spirits would not suffer to stand till some human victim had been buried alive; a service for which Oran offered himself, and his red grave-stone is still to be seen near the door. In this chapel are tombs of several chiefs, and others. A little north-west of the door is the pedestal of a cross, on which are certain stones that seem to have been the supporters of a tomb. Numbers who visit this island think it incumbent on them to turn each of these thrice round, according to the course of the sun. They are denominated *Clachabrath*; for it is thought that the *brath*, or end of the world, will not arrive till the pedestal on which they stand is worn through. Mr Sacheverel informs us, that originally there were here three noble globes of white marble, placed on three stone basons, and that these were turned round; but the synod ordered them and sixty crosses to be thrown into the sea. The present stones are probably substituted instead of these globes. The precinct of these tombs was held sacred, and enjoyed the privileges of a girth or sanctuary. These places of retreat were, by the ancient Scotch law, not designed to shelter indiscriminately every offender, as was the case in more bigoted times in Catholic countries; for here all atrocious criminals were excluded, and none but the unfortunate delinquent or the penitent sinner was shielded from the instant stroke of rigorous justice. A little to the northward of this enclosure stands the cathedral, built in the form of a cross, 115 feet long by twenty-three broad, and the transept seventy feet; the pillars of the choir have their capitals charged with scriptural and other histories; and near to the altar are the tombs of two abbots and a knight. A fragment remains of the altar stone, of white marble veined with gray. This church is ascribed to Maldwin, in the seventh century; but the present structure is far too magnificent for that age. Most of the walls are built of red granite, from the Nun's Island in the Sound. Two parallel walls of a covered way, about twelve feet high and ten wide, reach from the south-east corner to the sea. In the church-yard is a fine cross of a single piece of red granite, fourteen feet high, twenty-two inches broad, and ten inches thick. Near to the south-east end is Mary's chapel. The monastery is behind the chapel, of which only a piece of the cloister remains, and some sacred black stones in a corner, on which contracts and alliances were made and oaths sworn. To the east of it were the abbot's gardens and offices; and to the north was the palace of the bishop of the isles after the separation from them of Man. This see was endowed with thirteen islands, several of which were frequently taken away by the chieftains. The title of *Soder*, which some explained as Σωτηρ, *Soter*, the name of Christ, or Soder an imaginary town, is really derived from the distinction of the diocese into the northern islands or Nordereys, that is, all to the north of Ardnamurchan Point, and the Southern or Sudereys; which last being the most important, the Isle of Man retained both titles.

Other ruins of monastic buildings and offices may be traced, as well as some druidical sepulchral remains. Several abbeys were derived from this, which, with the island, was governed by an abbot-presbyter, who had rule even over bishops. The place where St Columba landed is a pebbly beach, where a heap of earth represents the form of his ship. Near it is a hill with a circle of stones called *Cnoc-nan aimgeal*, or "the hill of angels," with whom the saint held conference; and on Michaelmas day the inhabitants coursed their horses round it, a relic of the custom of bringing them there to be blessed. In former times this island was the place where the archives of Scotland and many valuable old manuscripts were kept. Of these most are supposed to have been destroyed at the Reformation; but many, it is said, were carried to the Scotch college at Douay in France, and it is hoped some of them may still be recovered. In 1830 an intelligent antiquary cleared away the rubbish from the ruins of the religious edifices, for the purpose of bringing to light every relic that might remain. In this search, besides the advantages resulting from disentombing these interesting ruins, and exposing them to the eye of the visitor, a great many statues and monuments were discovered.

IONIA, a district of Asia Minor, extending along the coasts of the Ægean Sea about 3430 stadia ($428\frac{3}{4}$ miles), according to Strabo, if we include the sinuosities of the coast, though by land the distance was much shorter. To the north its boundary was the cape near which stood the city Phocæa, close to the river Hermus; and to the south the promontory Posidium, in the Milesian territory, on the left bank of the Mæander. It was separated in the interior from the plain of Lydia by a chain of mountains extending from the river Hermus, now *Sarabat*, to the Caÿster, a ridge which was known to the ancients by the celebrated names of Tmolus and Sipylus. A continuation of this ridge, under the name of Messogis, ranged along the rest of the Ionian coast, till it terminated in the promontory of Mycale. The fertility of this small district was only equalled by the excellence of its climate, and every creek furnished excellent harbours for shipping. Its inhabitants rivalled Greece in all the arts and sciences, and in elegance and purity of taste excelled even the mother country. The Ionian temples were remarkable for their grandeur of design and beauty of proportions, and the schools of painting and sculpture were the admiration of the world. Ionia was watered by the river Hermus, now *Sarabat*, whose waters were said to bring down golden sands; the Cayster, now the *Little Mendere;* and the Mæander, now the *Great Mendere.*

We find the Ionians first occupying Attica and that part of the Peloponnesus called Ægialos, but afterwards better known as Achaia. From this district they were driven out by the Achæi, and took refuge in Attica, where they found a dispute respecting the succession to the throne of Athens, between Medon and Neleus, the descendants of Codrus. When the oracle of Delphi decided in favour of the former, Neleus determined to abandon this country and seek a settlement elsewhere. He invited the Ionians to join him, and having set sail with a large body of Greeks collected from every part of the country, he, along with several of his brothers, proceeded to the coast of Asia, where they founded cities on that part of the coast which was from them called Ionia. The cities were twelve in number, and, not long after their foundation, united themselves into one political body, called the Ionian confederacy. Their names were Miletus, Myus, and Priene, in the district of Caria; Ephesus, Colophon, Lebedus, Teos, Erythræ, Clazomenæ, and Phocæa in Lydia; Samos and Chios on the islands adjacent to Lydia. Smyrna was in later times admitted to the privileges of this confederacy. They held their solemn meetings and festivals in a temple called Panionium, dedicated to the Heliconian Neptune, and erected on the promontory of Mycale, opposite to Samos. The government of each state seems to have been monarchical, but they do not appear to have made any vigorous efforts to maintain their independence. We find them first subject to the effeminate Lydians, and afterwards to the more powerful but equally mild sway of the Persians. There were, indeed, some instances of patriotic resistance; but as a nation they showed themselves weak and contemptible. They indeed made one bold effort to throw off the Persian yoke, about 500 B. C., led on by Aristagoras and Histiæus; but they proved unequal to the task. Though they showed much zeal and ardour in the commencement of the undertaking, they had not perseverance sufficient to insure success in a protracted contest with the power of Persia. The taking and burning of Sardis served only to exasperate the Persians, and they found themselves soon afterwards obliged to give up all resistance by land. (Herodot. v. 98–123.) The contest was still carried on by sea; but here also they were unsuccessful, and they found themselves compelled to acknowledge the superior power of the Persian monarch. (vi. 7–23.) The victories of the Greeks over Darius and Xerxes, B. C. 490 and 480, enabled Ionia for a short time to regain her freedom; but the battle of Mycale transferred her once more to a foreign power. She now became subject to the Athenians, and during the Peloponnesian war, B. C. 431–405, we find them drawing considerable resources from the tribute imposed on the Ionians. When the Athenians were defeated in Sicily, B. C. 413, they made great efforts to preserve Ionia from the united attacks of Sparta and the Persian satrap Tissaphernes. It does not appear that the Ionians themselves felt much interested in the result of the contest, as no city except Miletus took part in the dispute. But the peace of Antalcidas, B. C. 387, replaced the Ionians in their wonted condition of slaves to the Persian monarch; and neither the passage of Alexander through their country, B. C. 333, nor the subsequent disputes of his captains, seem to have made any material change in their condition. From the weak government of Antiochus they passed under the sway of the Romans, and then became merged in the mighty empire of the latter. From this time they can no longer be considered as a distinct people.

IONIAN ISLANDS.

Ionian Islands.

The Ionian Islands formerly constituted a small part of the Venetian dominions; and, by a fate somewhat singular, they were raised to the rank of an independent power without any efforts of their own, at the very period which witnessed the extinction of Venice itself, with Genoa, Ragusa, and many other small states which had existed for ages. These islands, which are seven in number, exclusively of some small dependent islets, are situated on the western and southern shores of Greece, between 36° and 40° of north latitude, and between 19° 40′ and 23° 10′ of east longitude. Four of them lie in a group opposite the entrance of the Gulf of Corinth; two others, Corfu and Paxo, are situated about eighty miles north-west of this central group, from which Cerigo, the remaining island, is distant about 150 miles south-east. The subjoined table gives a view of their extent and population; but the measurements can only be considered as approximations, as, we believe, no accurate map of all the islands has ever been published.

Modern Names.	Ancient Names.	English Square Miles.	Population.	Authorities.
Cephalonia[1]....	Cephalenia.........	500	60,000	Holland, 1812.
Corfu..........	Corcyra, Phæacia..	270	60,000	Vaudoncourt, 1807.
Zante..........	Zacynthus..........	180	33,352	Williams, 1815.
Santa Maura...	Leucadia...........	150	18,000	Holland, 1812.
Cerigo.........	Cythera.............	130	9,000	Do. 1811.
Theaki.........	Ithaca...............	60	9,400	Williams, 1815.
Paxo...........	Paxus................	20	3,968	Do.
		1310	193,720	

According to this table, these islands contain about 150 persons to each square mile, a density of population nearly equal to that of the most populous countries of Europe, and very remarkable, considering how a great proportion of their surface is too rugged to admit of any species of cultivation.

Climate and diseases.

The climate of the Ionian Islands resembles that of the continent of Greece, except that the surrounding seas temper in a greater degree the extremes of heat and cold, and render the atmosphere more humid. Snow often falls during the winter, and lies on the high grounds, but very rarely in the plains. The winter rains sometimes bring with them great quantities of a reddish sand, which the people think has been transported from Africa by the south wind. Sudden and furious squalls are frequent, and the Sirocco, or hot wind, which occurs at certain periods, produces the usual effects, a dull headach, lassitude, and a sense of oppression. The harvest, which is generally in May on the continent, is here in June. Earthquakes are very frequent, though not often very destructive. In Zante, two or three sometimes occur in a month; it is observed that they are preceded by a peculiar state of the atmosphere, producing a feeling of heaviness, or a sulphurous smell, and that they are generally followed by rain. Malaria prevails in low situations in the autumnal months; and the itch, which is common in some parts, instead of being eradicated by medical means, is rather cherished by the people, from a strange notion that it is a preservative against malaria. In other respects the climate is agreeable and healthy, and instances of remarkable longevity are known.[2]

Geology.

The rocks of all these islands belong to the same great calcareous formation which occupies the continent of Greece. They contain some, though very few, organic remains, and are disposed in highly inclined strata. The limestone, which is accompanied occasionally with beds of gray foliated gypsum, and with beds or masses of sandstone, is conjectured by Dr Holland to belong to the first flœtz limestone of Werner. At one spot, ten miles south of the town of Zante, are found a number of pitch wells, agreeing in their situation and appearance with the description given by Herodotus two thousand four hundred years ago. They consist of small pools of water, fed by springs, in a marshy tract near the shore, having their sides and bottoms lined with petroleum in a viscid state, which, by agitation, is raised to the surface in flakes. It is collected once a year, and the produce is about a hundred barrels.[3]

Topography.

The surface of all these islands is so remarkably mountainous, that they do not contain a quantity of arable land nearly sufficient to afford corn to the population; and were it not that the vine, the olive, and the currant, enable them to extract a valuable produce from their rocks and declivities, they could support but a very small number of inhabitants. There is a considerable diversity, however, in the aspect and qualities of the surface of the different islands, which renders it necessary to speak of their topography separately.

Corfu.

To begin with Corfu, the most northern, and the seat of the general government. This island, which is about forty English miles long, and fifteen in extreme breadth, lies opposite the coast of Albania, from which it is separated at one point by a strait two miles broad. A range of mountains occupies the centre of this island, the highest summits of which, Mount Kassopo, must be nearly 4000 feet high, since the coast of Italy, at eighty miles distance, is visible from it. The island is rather bare of wood, and not abundant in good pasturage. Wheat is raised in some low situations near the coast; but though called "fruitful Corcyra" by Dionysius, and celebrated for its riches by other ancient authors, its inhabitants de-

[1] The ancient geographers had a very imperfect idea of the extent of these islands. Strabo (lib. x.) estimates the circumference of Cephalonia at thirty miles (300 stadia), instead of 100; that of Zante at sixteen miles, instead of sixty; and that of Ithaca at eight miles, instead of forty. Pliny (lib. iv.) gives forty-four Roman miles as the circumference of Cephalonia, and thirty-six as that of Zante.

[2] Holland's *Travels in Greece*, p. 20, 37, 47; Williams's *Travels in Greece*, letters xlix. l.; Turner's *Tour in the Levant*, i. 202, 204.

[3] Holland, chap. i. and ii.

pend chiefly on importation for corn, which they procure in exchange for their wine, oil, and salt. The capital, also named Corfu, which lies on the east side of the island, contains about 15,000 inhabitants, and is a pretty strong place. This island is the Phæacia of Homer. A small bay, five or six miles south of the capital, is conceived to be the Alcinus Portus, where Ulysses, after his shipwreck, met with the daughter of Alcinous; and Fano, a small rocky islet seven or eight miles in circumference, lying twelve miles off the north-west coast of Corfu, is the island of Calypso.[1]

Paxo. Paxo, the next in order, which is about seven miles long and three broad, lies eight miles south-east of Corfu, and twelve miles west of the coast of Albania. Its surface is highly beautiful, much enclosed, and nearly covered with olive trees. Its capital, St Gago, contains a great proportion of the population, amounting to 3948 persons, who depend very much on trade for their subsistence. Antipaxo, an islet five or six miles in circumference, and inhabited by a few fishermen, lies near it.[2]

Leucadia. Santa Maura, about twenty miles long and eight or nine broad, lies so close to the coast of Greece that it was formerly joined to it by an isthmus. It is sixty miles south-east from Corfu, three miles from Ithaca, and five from the nearest point of Cephalonia. The surface consists of a range of limestone mountains, which rise to the height of nearly 3000 feet, and terminate on the south-west in the celebrated Leucadian promontory, where unhappy lovers, following the example of Sappho, came to cure themselves of an unrequited passion. The cliff is not very lofty, though sufficiently so for the purposes of despairing lovers. It is still the custom of the neighbouring mariners, when passing, to throw in a small piece of money as an expiatory offering. The island contains very little level surface. Its principal products are olives and vines; and salt is made on the coast. The capital, also named Santa Maura, containing 5000 inhabitants, is situated at the northern point of the island, where it is separated by a narrow channel from the continent. The ancient name, Leucadia, or, as it is now pronounced, Lefcadia, is still known among the inhabitants, and ought to be used to distinguish the island from its capital.[3]

Ithaca. Theaki, the ancient Ithaca, the regal seat of Ulysses, consists merely of a narrow ridge of limestone, seventeen miles long and four in extreme breadth, rising into rugged eminences, with scarcely a hundred yards of continuous level surface in its whole extent. Near the middle it is intersected by a deep bay, which penetrates four miles inwards. Upon this bay the town of Vathi, the capital, is situated, containing 2000 inhabitants. The chief produce of the island is currants; but it yields also a small quantity of oil and wine, the latter much esteemed. The grain raised suffices only for three months' consumption. On a hill near Vathi are some massive ruins of ancient walls, with a number of sepulchres, which are supposed to mark the site of the capital of Ulysses. Near the south-east end of the island is a cliff called Koraka at present, and supposed to be the rock Korax, mentioned in the Odyssey; and under it, in a secluded and picturesque spot, is a fountain, conceived to be that of Arethusa, where Ulysses met the faithful Eumæus. The island is still named Ithaca by the more intelligent natives, which is corrupted into Theaki by some of the lower classes. Between Ithaca, Santa Maura, and the continent, are situated four small rocky isles, named Meganisi, Calamo, Atako, and Carto, besides several minute islets, of little or no importance.[4]

Ionian Islands.

Cephalonia. Cephalonia, three miles from the nearest point of Ithaca, is the largest of all the Ionian Islands. Its greatest length is forty English miles, and its greatest breadth twenty-four. A lofty chain of mountains, the Mount Ænos of antiquity, nearly 4000 feet high, occupies the centre of the island, and sends off branches to all the principal promontories. The wood which covered a part of these hills was wantonly burnt, about twenty years ago, during some internal disturbances. A deep gulf penetrates far inland from the south side of the island; and, upon the east side of this gulf stands Argostoli, the capital, containing 4000 inhabitants. Lixuri, the only other town, contains 5000 inhabitants; and there are in the island 175 villages.[5] The surface of Cephalonia is generally rocky; the soil thin, and less fertile than that of Zante. Its chief productions are currants, oil, and wine. Some ruins of Cyclopian walls mark the site of the city of Samus, mentioned by Homer; and there are some remains of Krani, Pronos, and other ancient cities. Vestiges of the altar of Jupiter Ænesius are said still to exist on the top of Mount Ænos.[6]

Zante. Zante, which lies ten miles south from the nearest point of Cephalonia, is about sixty miles in circumference. Unlike the neighbouring islands, its surface consists chiefly of a large plain, reaching from the southern to the northern coast, but bounded on the east and west sides by calcareous ridges about 1200 or 1300 feet high. This plain, covered with vineyards and olive groves, with only a few spots in tillage, presents the appearance of luxuriant fertility, and has procured for the island the title of the "Garden of the Levant." The capital, Zante, situated on the eastern side of the island, contains 18,000 inhabitants. Zante contains very few antiquities; and, though smaller and inferior in population to some of the other islands, is the richest of them all.[7]

Cerigo. Cerigo, the ancient Cythera, the last of the seven islands, is about fifty miles in circumference, and is situated near the south coast of the ancient Laconia, 150 miles from the nearest of its Ionian confederates. The face of the island is mountainous, and, though reported to be the birth-place of Venus, it is rugged, barren, and destitute of beauty. Its productions are similar to those of the other islands, but it is less commercial; and, abounding more in pasturage, it raises a considerable number of sheep and cattle.[8]

Agriculture. Landed property, in all the islands, is in the hands of a comparatively small number of persons, who form a proud, oppressive, and rapacious aristocracy. The Venetian senate, whilst it possessed these islands, kept all the more solid advantages to its own citizens, but bestowed titles, which cost nothing, profusely upon the petty insular chieftains; and nobles, destitute of education, honour, or property, are as common here as in Italy. The lands are generally let by the year, the tenant paying half the produce to the landlord; a species of tenure almost universal in rude countries. In Cephalonia, where property is pretty much divided, the largest proprietor has not above L.800 or L. 900 a year; but in Zante there are estates of more than double this value.[9] In the rural economy of the Ionian Islands, corn is an object of secondary importance, and farming is conducted on the rudest principles. Barley, wheat, maize, and oats, are cultivated, but the quantity of grain of all kinds raised does not exceed one half, and in some of the islands is not one third, of the annual amount of consumption. Of the corn raised in Ithaca, one tenth is wheat and nine tenths barley. The

[1] *Memoirs of the Ionian Islands*, by General Guilliaume de Vaudoncourt, translated by Mr Walton, chap. xi.
[2] Vaudoncourt, chap. xi.; Williams, let. xlviii.
[3] Holland, chap. iii.; Vaudoncourt, chap. xi.
[4] *Ibid.* chap. iii.
[5] Turner, 192.
[6] Holland, chap. ii.
[7] *Ibid.* chap. i.
[8] Galt's *Voyages and Travels*, 1812, p. 137; Holland, chap. iii.
[9] Holland, 36.

Ionian Islands.

returns of the former are estimated at six or seven, and of the latter at eight or nine, for one.[1] Flax and cotton are cultivated to a small extent in several of the islands. Cephalonia is computed to yield of the latter 100,000 pounds annually, of an excellent quality.[2] The number of oxen, sheep, and goats, is considerable in the islands less adapted to the cultivation of the currant, vine, or corn; but others, such as Zante, have very few, and all are partly supplied with cattle and poultry from the Morea. Milk cows are rare, the milk of goats being preferred for ordinary use, as well as for the manufacture of cheese. The produce of wax and honey in some of the islands is very great. Cerigo is stated to have had 1280 hives in 1811, and 60,000 or 80,000 pounds of honey of an excellent quality are collected annually in Cephalonia.[3]

Olives.

The cultivation of vines and olives is an object of greater attention to the inhabitants than that of corn, and is more skilfully conducted. Nine sorts of olives grow in Zante, differing considerably in their qualities. The fruit begins to ripen in November, but does not fall off till towards the end of December or the beginning of January. This is the time when they are gathered, but in some places they are plucked with the hand, and not allowed to fall. They are carried to the mill in April, but the harvest is not entirely at an end till the month of May. The oil is carried to the sea-ports in sheep-skins. Olives are cultivated to the greatest extent in Corfu, where the produce collected every two years amounts, in middling seasons, to 700,000 jars or 90,000 barrels[4] annually. Zante produces about 30,000 barrels; Cephalonia, 30,000; Leucadia, 3000; Paxo, 8500; and Ithaca, 1500. Including Cerigo, the annual produce of olive oil will not be much less than 200,000 barrels. While the Venctians were masters of the island, and retained a monopoly of the oil trade, the price averaged from forty to forty-three livres of Corfu (6s. 8d. to 7s. 2d.) per jar; but in 1802 it rose to sixty livres (10s.); and in 1807 (a dear year) was seventeen and a half dollars per barrel, or about 19s. per jar. The oil is of four different qualities, the finest of which is fit for the table, and the other three species are used in various manufactures.[5]

Grapes.

Wine is made in all the islands to a small extent. In Zante, forty species of grape are distinguished, but the small black species, known under the name of currants, is the only kind extensively cultivated. Ithaca produces about 12,000 barrels of wine annually, of a quality superior to that of the other islands, and which sells at about twenty dollars per barrel. Cephalonia produces from 30,000 to 35,000 barrels of good wine. Zante yields only about 4000 barrels; Leucadia 1000. The produce of the other islands is not known.[6] Oranges, lemons, and citrons, are raised in several of the islands, both for domestic use and exportation; and salt is supplied for exportation in large quantities from Corfu and Leucadia.

Currants.

The currant is the staple produce of Zante, where it occupies nearly two thirds of the cultivated land. It is raised also in Cephalonia and Ithaca, but does not succeed in Corfu or Leucadia. Its culture is conducted with great neatness, and when the flower is out, the aspect of the great vineyards is singularly rich and beautiful. It thrives best in a deep rich soil, at the foot of mountains. The currants are gathered about the beginning of September, somewhat sooner than other grapes; are spread abroad for eight or ten days, and are usually ready for packing by the end of September. The annual produce of Zante is from 7,000,000 to 8,000,000 pounds, the price of which in the island varies from 14s. to 18s. per hundredweight. Cephalonia yields from 5,000,000 to 6,000,000 pounds, and Ithaca 500,000. The whole produce of the Ionian Islands in this article may therefore be estimated at 13,000,000 or 14,000,000 pounds.[7]

Annual produce.

Mr Williams gives the estimated value of the annual produce of the three islands, Zante, Paxo, and Ithaca, in corn, wine, oil, currants, honey, and flax, the chief productions, but excluding minor articles, such as cheese, fruit, &c. The estimates appear to be official, and as they are probably deduced from surveys made for the purpose of taxation, they are entitled to some degree of confidence; but it would have been more satisfactory had he stated upon what basis they were formed. The annual produce of Zante, in 1815, is stated at 1,066,145 dollars, or L.234,000; that of Ithaca, 98,896 dollars, or L.22,000; that of Paxo, 104,018 dollars, or L.23,000. These three statements give, on an average, L.6 sterling of produce for each inhabitant; but as some of the other islands are less favourably situated, L.5 is probably high enough as a mean; and if we compute the annual value of the produce of the whole on this principle, it will be L.970,000,[8] or, in round numbers, L.1,000,000 sterling; and this is exclusive of what is derived from commerce and the mechanic arts.

Commerce.

The situation of the Ionian Islands gives them naturally, and in some measure necessarily, a commercial character. Their position near the coast of Greece, where the tyranny of the Turks renders property so insecure, tends to make them a medium of communication with that country, and an entrepôt for its commodities. The narrowness of their territories, which obliges them to import provisions, and the peculiar nature of the soil and climate, which are better adapted to raise other productions than corn; their insular situation, and long connection with the Venetians; all dispose them to engage largely in commercial transactions. The trade of the islands, considering their extent and circumstances, is, in truth, considerable, and has increased greatly since it was freed from the shackles imposed upon it by the monopolizing spirit of the Venetians. The exports consist of olive oil, currants, wine, honey, wax, salt, soap, oranges, lemons, tobacco, cheese, &c. The imports are corn, woollen, cotton, and linen goods, velvets, cured fish of various kinds, sugar, coffee, iron, lead, dyestuffs, paper, drugs, spices, &c. Zante, in 1815, exported goods to the value of 591,000 dollars. Cephalonia has 250 vessels of various sizes. The little island of Paxo has 56 vessels, and exported goods to the value of 96,000 dollars in 1815. Ithaca, in 1815 or 1816, had 3598 tons of shipping, which, with boats belonging to the island, employed 823 men, and 74,360 dollars of capital. The little island of Cerigo, the least commercial of the whole, had, in 1809, only about twenty-five vessels, nearly all boats, employing 230 men. The number of Ionian vessels that trade with Turkey was estimated, in 1816, at 250, of which 200 were under their own flag, and fifty under the Russians. We should probably not err much if we estimated the exports of the whole islands at something more than double those of Zante, or about one third of the computed gross produce of the land, namely, L.300,000 sterling. A great number of their vessels trade with the Russian ports in the

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[1] Williams, *Appendix*, No. iii. [2] Vaudoncourt, 438. [3] Vaudoncourt, 437; Holland, 43.

[4] The barrel rather exceeds the millerole of Marseilles, or 59·7 *litres* (Vaudoncourt); and, according to Williams, is equal to 128 English pints. These accounts agree, and the barrel may therefore be considered as one fourth of a hogshead.

[5] Vaudoncourt, chap. xii.; Holland, chap. ii. and iii.; Williams, p. 173, and *Appendix*, No. iii.; Walpole's *Memoirs relating to Turkey*, p. 288.

[6] Holland, p. 22; Vaudoncourt, chap. xii.; Williams, *Appendix*, No. iii.

[7] Holland, chap. ii. and iii.; Vaudoncourt, chap. xii. [8] Williams, 72-183, and *Appendix*, No. iii.

Black Sea, for corn; others with Malta, Greece, Italy, France, and Spain. In the intercourse between the islands which lie near one another, a species of long, slender boat is used, named *Monoxylon,* made of a single piece of wood, preserving both the form and the name of the vessels used in the earliest and rudest stage of Greek navigation.[1] The interest of money, in common cases, is ten per cent. The merchants are generally poor and unenterprising, but a few individuals have accumulated considerable fortunes.[2] One individual, a nobleman, is mentioned, who is said to possess a million of dollars. If these islands continue to enjoy tranquillity, and if their internal economy is improved, it is probable they will attract a considerable part of the trade which now centres in Salonica, Hydra, Specchia, and other Turkish ports, where the merchants are exposed to loss and vexation from the rapacity and violence of the Turkish government.[3]

Public Revenue.

The public revenue arises from a tithe or impost on the various species of produce raised within the country, grain, wine, oil, flax, and cattle; from a tax on hearths or inhabited houses, a tax on oil presses, and from duties of customs on articles exported and imported. The produce of these various duties, in 1815, was as follows:

REVENUE.

	Eventual Revenues.	Fixed Revenues.	Totals.
	Dollars.	Dollars.	Dollars.
Zante	71,779	83,015	154,795
Cephalonia	79,807	8,387	88,194
Leucadia	2,011	36,271	38,283
Ithaca	1,976	6,693	8,669
Paxo	240	6,717	6,957
Cerigo	130	5,570	5,700
Parga	35	1,623	1,667
	155,978	148,285	304,265

EXPENDITURE.

	Dollars.
Zante	102,688
Cephalonia	64,174
Leucadia	34,973
Ithaca	5,403
Paxo	6,107
Cerigo	1,956
Parga	4,267
	219,568, equal to L.48,500.
Revenue	304,265
Surplus	84,698[4]

This small expenditure appears to include only the charges of the civil government, and perhaps not the whole of these. The body of 3000 troops, chiefly British, kept in the islands, would alone evidently absorb a larger revenue. And although it was fixed by the constitution that the islands should defray the expense of their own military establishment, it appears, in point of fact, from a parliamentary paper (dated 25th of February 1820, No. 87), that the British government incurred an expense of L.145,203 in the Ionian Islands in 1817, and L.120,045 in 1818, for purposes chiefly military, but partly civil. It is difficult to conceive that there can be any British objects in that quarter requiring such an expenditure, or that the money has been advanced provisionally, to be afterwards repaid, since the revenues of the islands must now be on a permanent footing. There remains but one admissible supposition, that these islands are to form a permanent burden on the people of Britain; and yet, at a period when our own expenditure presses so heavily, it seems little less than infatuation to increase our difficulties gratuitously, by relieving a distant country, less heavily taxed, of the expense of defending itself.

Constitution.

The existing constitution of the Ionian Islands, which was sanctioned by its own legislative assembly in 1817, vests the supreme power in the high commissioner, the senate, and the legislative assembly, which have jointly the title of the Parliament of the Ionian Islands. The legislative assembly consists of forty members, of whom twenty-nine are elective and eleven *integral,* and all must belong to the class of *synclitæ,* or nobles, the common people having nothing to do with the laws but to obey them. The eleven *integral* members consist of the president and members of the old senate, with the regents or governors of the five largest islands, all of whom are substantially, though not directly, nominated by the high commissioner. The twenty-nine elective members are chosen by the nobles of the different islands, from prepared lists sent down by the primary council, in the following proportions:

Corfu	7
Cephalonia	7
Zante	7
Leucadia	4
Ithaca	1
Cerigo	1
Paxo	1
	28

And each of the last three in rotation elects a second member, which makes twenty-nine. The legislative assembly elects its own officers, fixes the amount of the supplies, and all its members have the power of proposing new laws or regulations.

The primary council, mentioned above, which acts only during a dissolution of parliament, consists of the president and members of the last senate, with five members of the last legislative assembly, nominated by the high commissioner.

The senate consists of five members and a president, the latter appointed directly by the high commissioner. The five members are elected by the legislative body out of its own number, and confirmed by the high commissioner. If he negative the election of an individual, another is elected; and if he negative the second also, the vacancy is filled up by his nominating two individuals, of whom it then falls to the legislative body to choose one. This senate is an executive council as well as a deliberative body. It nominates most of the officers under the general government, such as judges, regents, archivists, &c.; but its nominations must be confirmed by the high commissioner. It makes regulations during the recess of the legislative assembly, which have, *pro tempore,* the force of laws; and it deliberates and decides upon all propositions submitted to it by the high commissioner, or sent up from the lower house, but its members have not a power to initiate legislative proceedings.

[1] Potter's *Antiquities*, book iii. chap. xiv.
[2] Williams, vol. ii. 183.
[3] Holland, chap. i. ii. iii.; Vaudoncourt, chap. xii.; Turner, vol. iii. *Appendix*.
[4] Williams's *Travels*, *Appendix*, Nos. ii. and iii.

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The legislative assembly and the senate are elected for five years, but may be dissolved at the lapse of a shorter period by the high commissioner. The appointments of judges, regents, and other officers, are also for five years.

The high commissioner is nominated by the protecting sovereign. He appoints the president of the senate, who has the initiative of all proceedings in that body. He appoints a resident for each of the islands, who has the power of suspending any proceeding of the local government. He nominates a number of officers, and has a negative, direct or indirect, upon the appointment of most of those whom he does not nominate. He has a *veto* on all propositions which have passed the two houses; but though he give his sanction to any specific measure, there is still another *veto* behind, lodged in the king of Britain, who may annul the proceeding at any period within one year of its enactment.

Each island has a local government, consisting of a municipal council of five members, selected by the regent (with the approbation of the high commissioner), out of a list of ten, chosen by the *synclitæ*. And besides these, there are five active functionaries, a regent, secretary, fiscal, archivist, and treasurer, all, except the last, nominated by the senate, and confirmed by the high commissioner.

The judicial power is lodged in a supreme court at the seat of government, consisting of four ordinary and two extraordinary members. Of the former, two are native Ionians, named by the senate, and approved of by the commissioner; and two, directly named by the commissioner, may either be British subjects or Ionians. When these four are equally divided on any question, reference is made to the two extraordinary members, who are the high commissioner and president of the senate. Subordinate to this supreme court are twenty-one inferior tribunals, that is, a civil, a criminal, and a commercial tribunal in each island. And under these, again, are justice of peace courts, for minor offences, and small civil suits. Besides the general appellant jurisdiction which the supreme court has over the local tribunals, it is empowered to send a delegation of its members on circuit on special occasions, when thought necessary by the senate and high commissioner. The number of judges in the local courts is not fixed by the constitution.

The *sanita*, or health establishment, is under the sole direction of the high commissioner. The army, consisting entirely of the troops of the protecting sovereign, is also under the orders of his representative. The expense of the army is to be defrayed by the islands if the number does not exceed three thousand men. There is, besides, a national militia, commanded by native officers.

Individuals, or bodies of men, have the right of representation or petition to the protecting sovereign or his ministers.

We have described this constitution more in detail than its importance merits; for, without exaggeration, it may certainly be pronounced to be the very worst among the numerous plans of representative government framed within the last thirty years. It is, in fact, little else than a compact between the British government and the petty despots of the islands, settling in what proportions the power, patronage, and taxes of the country are to be shared between them. The rights and interests of the mass of the people, for which even the German princes in their new constitutions profess a decent respect, are not the object of one single stipulation in this long and detailed instrument.

The style of building in the Ionian Islands is chiefly Italian, and the interior of some of the cities shows great neatness. The streets are generally narrow; the houses, some of wood, some of stone, are three, four, or even five stories high, with open latticed windows. The shops are tolerably well supplied with manufactured and colonial articles; and the persons employed in them display more alertness and civility than the indolent shop-keepers of Spain, Portugal, and Sicily. The churches, as in Greece, are disproportionately numerous. Some of them have steeples, others have merely an elevated façade. The population, in consequence of the long dominion of the Venetians, is, in manners and habits, as well as in costume and language, intermediate between the Greek and Italian character. Though enjoying more liberty, they are, in some respects, inferior to the continental Greeks. Their exterior is less dignified, their manners more corrupt, and they show less capability of again becoming a people. This degradation of character may be attributed chiefly to the vicious nature of the Venetian government. The governors and judges whom it sent out to the islands were very often nobles of decayed fortune, who undertook the duties as a speculation to retrieve their affairs. Bribery was practised openly; toleration for a crime might easily be purchased; and the laws, imperfect in themselves, were rendered wholly null by the corruption of the judges. The petty insular aristocracy separated into factions, which trampled on the laws and oppressed the people. The Venetian government, by a detestable policy, encouraged their feuds to prevent their combination, and exposed the country to all the evils of a continued civil war. As happens in all countries where justice is denied by the laws, private revenge and assassination prevailed to a frightful extent. In the island of Zante alone, with 33,000 inhabitants, the number of assassinations sometimes exceeded one for each day of the year. Many of the nobles, indeed, kept assassins in their pay; and others of them fitted out privateers for the trade of general piracy, in which the vessels of their own countrymen were not spared. These nobles are generally educated in Italy, and speak the Italian language; but in knowledge and refinement they are scarcely on a level with the middle ranks in England. The lower classes, like the continental Greeks, use the Romaic language, but with a larger mixture of Italian words; and, like them, too, they are active, ingenious, adroit, loquacious, subtle, and intriguing. Physic and law are favourite professions, and the better order of lawyers and physicians, who have been educated in Italy, form the most intelligent part of society. The clergy are extremely numerous, but less informed, and inferior in respectability to the two former classes. They were very active in resisting some of the reforms attempted by the British. When Major du Bosset introduced the culture of the potato in Cephalonia, they laboured to persuade the peasants that this was the very apple with which the serpent tempted Adam and Eve in paradise.[1] The women, as in Greece, are almost entirely secluded from society, and are, of course, ignorant, superstitious, and feeble in their character.[2] In all that regards the intercourse of the sexes much laxity of morals prevails, but the poor are less corrupted than the rich. Most of the nobility have mistresses, and the laws allow them to legitimate the issue of these connections by a subsequent marriage. A sort of agreement is not unfrequent, by which a young woman is made over by her parents, with her own consent, to her admirer, at a stipulated sum. This species of concubinage, which frequently terminates in marriage when the girl is respectable and has children, is, on other occasions,

Manners and customs.

[1] Holland, 41.

[2] Holland, chap. i. ii.

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the cause of much infidelity and unhappiness.[1] In the country the Greek dress is generally used, though with some modifications; but in the towns the Italian dress prevails, as well as the Italian fashions in the style of furniture and in the modes of social intercourse. It was a leading object in the policy of the Venetians, indeed, to extinguish the national spirit of the Ionians, to deprive them of the means of education, and to brutalize their character by every method in their power, that they might convert them into passive instruments of their sovereign will. But, after three centuries of such policy, there can be no doubt that the Venetians lost more by the odious nature of the innovations attempted than they gained in security by the result.[2]

The attachment of the Ionians to the Greek religion, however, has effectually resisted the innovating spirit of their masters. The Catholic worship is tolerated, but the national faith has lost little of its influence upon the minds of the people. Each island has its patron saint, in the efficacy of whose intercession the people are taught to believe. The British authorities humour the popular superstition in this particular; and, in Corfu, the patents from the health office bear to be "in the name of God, and by the intercession of Saint Spiridion." Ceremonies and processions, with fasts, frequent and severe, take the place of piety and good works. A ruffian engaged in a project of assassination has refused to taste animal food during the season of the fast. As in many other countries, the lower orders are comparatively strict in their religious observances, while indifference and infidelity are common among the higher classes. But, if religion is in a low state, it is not from the want of priests and churches, the number of which is out of all proportion to the number of inhabitants. The little island of Paxo, with 4000 inhabitants, has thirty-six churches; and Cerigo, with 9000 inhabitants, is said to have the incredible number of 260 churches or chapels, and 165 priests. These swarms of priests are a sort of privileged mendicants. They are, in general, too illiterate to understand religion themselves, and, of course, they are incapable of teaching it to others. But as they derive their subsistence chiefly from fees for absolution, and from gifts and offerings, they find it necessary to support their influence by filling the minds of those under their care with a thousand idle or pernicious superstitions. Besides the secular clergy, there are a number of regular religious in convents scattered over the islands, but of their number or condition we have seen no satisfactory account.[3]

The Ionian Islands make no considerable figure in ancient history. Cephalonia, Zante, Ithaca, and Santa Maura (then joined to the continent), formed part of the kingdom of Ulysses; and, if we may judge of their condition from the armament which their prince carried with him to the Trojan war, we should conclude that they were less populous and less improved than the continental parts of Greece. These islands, along with a part of the opposite continent, furnished only twelve ships, whilst the little island of Salamis, not one twentieth part of the extent, sent as many.[4] They were then, as at this day, under the power of a number of petty chieftains; and it is a proof of the accuracy of Homer's geographical knowledge, that their relative numbers, as stated by Telemachus,[5] correspond tolerably well with the actual extent and importance of the islands, Cephalonia having twenty-four, Zante twenty, and Ithaca twelve. At a later period, the Corinthians planted colonies in Leucadia and Corcyra, and probably in some of the other islands over which they maintained some degree of authority. The Leucadians sent 800 men to fight the Persians at Platæa, and the Cephalenians of Pale 200.[6] The Corcyreans, from their favourable situation, rapidly became strong by sea, and not only shook off their dependence on the parent state, but committed depredations on the commerce of the other Grecian cities, till the Athenians, shortly after the battle of Marathon, attacked them and broke their naval strength. The jealousy between the Corcyreans and Corinthians, about forty-five years later, led to hostilities between the parties, in which the Athenians were drawn in to take the part of the former; and the extension of this petty quarrel at length produced the celebrated Peleponnesian war. The Corcyreans had 120 triremes when the contest began, and were the second naval power in Greece.[7] The Zacynthians also, who were a colony of Achæans, and the Cephalenians, were generally leagued with the Athenians, and afforded them assistance in the expedition against Syracuse. The Leucadians we find adhering to the Corinthians.[8] When the Spartans invaded Corcyra, about thirty years after this, the country is represented as richly cultivated, finely planted, and abounding in wealth and luxury.[9] Cerigo, from its situation, was almost always an appendage to Laconia. These islands, with the rest of Greece, at length fell under the dominion of the Macedonians. In the wars between Philip and the Ætolians, however, we find the latter occasionally making use of the naval forces of the Cephalenians.[10] When the Romans established themselves in Greece, these isles, from the position between that country and Italy, were early occupied; and Corcyra is often mentioned as a station of their fleet in their subsequent wars.[11] They continued to follow the fortunes of the Roman empire nearly to the latest period of its decline; and they suffered from the ravages of the Goths, Wallachians, and other barbarous tribes, till they fell into the hands of the Venetians, some of them in the twelfth, and others in the thirteenth century. This nation also conquered various maritime towns on the continent of Greece, of which, as well as of some of the islands, the Turks occasionally dispossessed them. The Venetians first acquired the Morea in 1417, and lost it finally in 1715. The Turks, at this latter period, took Cerigo, and besieged the city of Corfu; but the Venetians becoming masters at sea, regained Cerigo, repulsed the Turks from Corfu, and took several continental towns.[12] The treaty of Campo Formio (October 1797), which annihilated the state of Venice, transferred to France the Ionian Islands, with their continental dependencies, consisting, at that time, of five sea-port towns, Butrinto, Gomenitza, Parga, Prevesa, and Vonitza. When the invasion of Egypt led to hostilities between France and Turkey in 1798, Ali, pasha of Albania, besieged and took Prevesa and the other continental towns, except Parga; and the islands, having been reduced by the fleets of Russia and Turkey, were erected into an independent state, by a treaty between these powers, dated 21st March 1800. They were placed under the protection of the Porte, as its vassals, and were to pay it an annual sum of 75,000 piastres.[13] The towns on the continent were ceded to the

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1 Williams, letters xlvii. xlviii.
2 Vaudoncourt, chap. ii. xii.
3 Holland, chap. i. ii.; Williams, letters xlvii. xlviii.
4 *Iliad*, lib. ii. 631.
5 *Odyss.* lib. xvi. 249.
6 Herodotus, lib. ix.
7 Thucydides, lib. i.; Xenophon, *Hist.* lib. vi.
8 *Ibid.* lib. ii. iii. vii.
9 Xenophon, *Hist.* lib. vi.
10 Polybius, lib. iv. 6.
11 Livy, lib. xxiv. xxxii. xxxvi. xxxviii.
12 *Abrégé Chronologique de l'Histoire Ottomane*, par M. de Lacroix, i. 172, ii. 700.
13 *Annual Register*, 1800; *State Papers*, p. 278.

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Porte, of four of which it obtained possession. But the inhabitants of Parga, dreading the merciless disposition of the Albanian pasha, took up arms in their own defence, and, favoured by the strength of their position, repelled his assaults. A constitution was given to the republic in 1803, which it is unnecessary to describe, as it has since been superseded. It is sufficient to say, that it was drawn up by Russian ministers of state, ignorant of the circumstances of the islands, and contained such a specimen of republican principles as might be expected from Muscovy. The war between Russia and the Porte in 1806 led to the occupation of the Ionian Islands by the former; but by a secret article of the treaty of Tilsit (June 1807), they were made over to France. The French, during their first occupation of the islands, had abolished the use of the Italian language in public acts, and re-established the Romaic. Connecting these possessions with his projects against Turkey, Napoleon was anxious to revive the national spirit of the Greeks. A Romaic newspaper was set on foot, and has been continued by the British; establishments for promoting scientific education were projected; and, to crown these schemes by a piece of French extravagance, the reckoning by olympiads was introduced. These projects held out only a distant prospect of good, but the expense of the large military force stationed by the French in the islands was a real and immediate grievance. In 1810, a British force, under General Oswald, took possession of Zante, Cephalonia, Ithaca, and Cerigo, almost without opposition; and also of Santa Maura after some resistance. Corfu and Paxo having garrisons too strong to be attacked, were merely subjected to a maritime blockade, which, however, could not be so rigorously enforced as to reduce them. They were surrendered to the British after the general peace in 1814. The Turkish government now renewed its claim to Parga, under the treaty of 1800, though that claim had been virtually set aside by subsequent circumstances. That government had entirely failed in affording the Ionian Islands the stipulated protection, since it had suffered first the Russians, and afterwards the French, to occupy them with a military force. It had been a party to subsequent treaties, by which this had been in substance annulled. The original treaty bound the Turks to protect the Parguinotes; and it was now obvious, from the fate of the other towns, and from the feelings of the inhabitants, that its surrender would be equivalent to a warrant for its destruction. Lastly, the British had no right to make over Parga to the Turks, for it was not reduced by our arms, but its inhabitants put themselves under our protection by a voluntary act, and upon the express condition that their town was to remain attached to the Ionian republic. From ignorance or inattention to these circumstances, however, the Congress of Vienna had resolved that Parga should be given up. And, in obedience to the mandate of this conclave of sovereigns, the soldiers of Ali took possession of the bare walls in June 1819; the inhabitants, amounting to 5000, having, to a man, emigrated to Paxo and the other islands, after receiving a very inadequate indemnity for the loss of their property.[1]

General remarks.

The Ionian Islands, either as a separate state or as a dependency of Great Britain, are of little importance. The interest felt in their fate was founded partly on classical associations, and partly on the means they were supposed to afford for restoring the Greeks to their existence as a nation. But, under the political system established in the islands, the hopes raised on the latter ground proved almost entirely chimerical. The Ionian Greeks must be enlightened and improved themselves before they can become useful auxiliaries in the work of enlightening and improving the rest of their countrymen. To effect this change in their character, and to create and nourish a national spirit, three things are indispensable, with which their new constitution leaves them entirely unprovided; a system of national education, a free press, and a free government. The British ministry, in patronizing a plan for erecting a university in the islands, began its operations at the wrong end. The first and most indispensable step is to increase the small number of schools at present in existence, till they become sufficiently numerous to afford common education to the whole population. A university may then be useful; but the Greeks can never be enlightened by giving a learned education to a few individuals, whilst the mass remains sunk in ignorance and superstition. On the other hand, when a moderate degree of knowledge is generally diffused, ardent spirits will emerge from the multitude, and rise to eminence by their native force, while their countrymen will then be better prepared to reap advantage from their exertions. At present a well-informed Greek finds his acquisitions useless. Again, without a free press in their native language, the Greeks cannot receive that political instruction which is necessary to fit them for becoming once more a nation; knowledge cannot be rendered popular, nor of course useful; and a university will become a mere establishment of sinecures, or an engine for propagating corrupt and servile doctrines, worse than ignorance itself. It is no solid objection that the Ionian Greeks are mere children in literature, and could not make a discreet use of the press. Feeble as their powers may be, they will continue children still, if they do not use them. Their own blunders will often be better instructors than the mature wisdom of others. With general education and a free press, should be conjoined the invigorating spirit of a popular government; not a government bottomed on close corporations and privileged classes, but one broadly republican in its forms and spirit. Whatever may be the defects of such a government, it is calculated, beyond all other human inventions, to call forth the energies of man. It was this inspiring power that carried forward the ancient Athenians in their brilliant career of improvement and glory; that raised the Italian and Dutch republics to sudden wealth and power; and that is already giving a new aspect to the vast continent of North America. The people are ignorant and disorderly, but probably not more so than the Athenians in the time of Solon, or the Italians in the thirteenth century, who were, nevertheless, found capable of supporting republican institutions. The errors into which their ignorance might have led them would most probably have soon cured themselves. And, at any rate, the Ionians are in that precise situation which would have divested such institutions of the dangers usually supposed to attend them. The natural influence of the British government, as the protecting power, would have moderated the violence of factions, and preserved the government stable amidst their struggles. Had a free, active, and enlightened community been raised up in these islands, speaking the language of Greece, and almost in contact with the country, the emancipation of the continental Greeks would not only have been secured by the joint operation of moral and political causes, but so much light would have been diffused among them, and such a good model set before them, that they would have been in a condition to make a wise and safe use of their independence, and step at once into the enjoyment of a free constitution. As matters have been managed, however, it would be foolish to expect that these islands will contribute

[1] *Edinburgh Review*, No. lxiv. art. i.; Holland's *Travels*, chap. ii.; Treaty between Britain and Russia, 5th November 1815.

in any material degree to the improvement of the Greeks. Exclusively of the prerogatives of the high commissioner, all power is vested in the nobles, who are universally described as the most worthless part of the population. Votes alone will command office; and the mass of the people, who have no votes to give, though not expressly, will yet be substantially excluded from every place of trust and honour, and kept in the same state of vassalage as under the Venetians. Public burdens will naturally accumulate, because those who impose taxes have a separate interest from those who pay them; and abuses will multiply, because the nobles, hanging on the government for support, are gainers by a system of waste and profusion. A free press, which would have corrected some of these evils, has been jealously guarded against by the constitution; and as for the right of petition, in a government so constructed, it must be an empty name. In all probability, then, the Ionians will consider the Turkish practice of insurrection as the only effectual method of making known their grievances. Accordingly, since the new constitution was promulgated in 1817, several attempts at insurrection have been made. But whether these have originated in the factious spirit of the nobles, or the discontents of the body of the people, has not been clearly explained. Yet though but little comparatively has been done for the people, the change has certainly been for their advantage. The administration of justice has improved; the private wars and open rapine of the nobles have been restrained; and the powers taken from these persons, and conferred on the commissioner, have been more beneficially exercised for the inhabitants at large. But a much more stable foundation would have been laid for good government, had the people been furnished with constitutional rights to protect themselves, even although they had not made a very wise use of those rights in the first instance.

IONIC ORDER. See ARCHITECTURE.

IONIC Dialect, in *Grammar*, a manner of speaking peculiar to the people of Ionia.

IONIC Sect was the first of the ancient sects of philosophers; the others were the Italic and the Eleatic. The founder of the Ionic sect was Thales, a native of Miletus, in Ionia, whence his followers assumed the appellation of *Ionic.* Thales was succeeded by Anaximander, and the latter by Anaximenes, both of Miletus. Anaxagoras Clazomenius succeeded them, and removed his school from Asia to Athens, where Socrates was his scholar. It was the distinguishing tenet of this sect that water was the principle of all natural things.

IONIUM MARE, a part of the Mediterranean Sea, at the bottom of the Adriatic. It lies between Sicily and Greece. That part of the Ægean Sea which lies on the coasts of Ionia in Asia is called the *Sea of Ionia*, and not the *Ionian Sea.* According to some authors, the Ionian Sea receives its name from Io, who swam across after she had been metamorphosed into a heifer.

IPHICRATES, one of the most celebrated generals of the Athenians, was a man of low origin, who raised himself to the highest rank by his prudence and military talents. The exact date of his birth and death is unknown; but he began to take an active part in the affairs of his country in 392, B. C. when he proceeded with Conon to oppose Agesilaus, who began to threaten the independence of Athens. At this time he defeated a *mora* of the Lacedemonians, a body of men then the most active and vigorous in Greece. (Xen. *Hell.* iv. 5, 11–18.) On the death of Thrasybulus, B. C. 389, Iphicrates was appointed to succeed him in the command of the troops on the Hellespont, and there laid siege to Abydos, which was commanded by Nicolochus, the Spartan general; but the result of the siege is not known. (v. 1, 6–7.) For many years we lose sight of Iphicrates; nor does he again appear on the stage till B. C. 374, when we find him commanding the mercenary troops of Persia in Egypt. Next year, when Corcyra was threatened by the united fleets of Sparta and Syracuse, Athens sent to the assistance of this island a fleet of sixty vessels, commanded, first by Timotheus, and afterwards by Iphicrates. The latter, assisted by the orator Callistratus, and Chabrias, attacked and defeated the Syracusans. (vi. 2.) History again fails us, and we hear nothing more of Iphicrates till B. C. 355, when he was sent, along with Timotheus and Chares, to recover Byzantium and some other cities which had revolted. The fleet commanded by these three generals was soon in presence of the enemy; and they were preparing to offer battle when a tempest dispersed part of their vessels. Chares wished, nevertheless, that they should engage in battle, but Iphicrates and Timotheus opposed the proposal. On this account they were recalled, and, being accused by Chares and Aristophon of treachery, Timotheus was most unjustly condemned, whilst Iphicrates, who defended himself, not only by his eloquence, but by arming a number of his friends, was acquitted (Nepos, *Timoth. et Iphicr.*) From that time he quitted the military service of his country. He was married to the daughter of Cotys, king of Thrace, and had by her a son named Menestheus.

IPHIGENIA, a daughter of Agamemnon and Clytemnestra. When the Greeks, going to the Trojan war, were detained by contrary winds at Aulis, they were informed by one of the soothsayers, that to appease the gods they must sacrifice to Diana, Iphigenia, daughter of Agamemnon. The father, who had provoked the goddess by killing her favourite stag, heard this with the greatest horror and indignation; and, rather than shed the blood of his daughter, he commanded one of his heralds, as chief of the Grecian forces, to order all the assembly to depart each to his respective home. Ulysses and the other generals interfered, and Agamemnon consented to immolate his daughter for the common cause of Greece. As Iphigenia was tenderly loved by her mother, the Greeks sent for her on pretence of giving her in marriage to Achilles. Clytemnestra gladly permitted her departure, and Iphigenia came to Aulis, where she saw the bloody preparations for the sacrifice. She implored the forgiveness and protection of her father, but tears and entreaties were unavailing. Calchas took the knife in his hand, and, as he was going to strike the fatal blow, Iphigenia suddenly disappeared, and a goat of uncommon size and beauty was found in her place for the sacrifice. This supernatural change animated the Greeks, the wind suddenly became favourable, and the combined fleet set sail from Aulis.

IPSWICH, a market and borough town, the capital of the county of Suffolk, sixty-nine miles from London. It stands on the side of a gentle elevation rising from the banks of the river Orwell, which is navigable for vessels of the smaller size to the bottom of the town. The country around it is fertile, and the banks of the river present most pleasing prospects. It is a place of great antiquity, and many of the houses still bear marks of their ancient erection. The streets are well paved; and there is a good market-place, well frequented four days in each week. It formerly contained nineteen parish churches, and still retains twelve, besides several places of worship for dissenters from the establishment. There is a town and a shire hall, and an extensive county jail. A college was established here by Cardinal Wolsey, a native of this place; but it fell with the founder. There is, however, an endowed classical school. Ipswich was formerly celebrated for its woollen manufactures, but that branch of industry has been removed to the northern counties. The chief trade at present is in building ships, and in exporting ship timber, corn, and malt; but it has a considerable import trade for wines, spirits, timber, ship-stores, and other commodities, the duty on which, in 1833, amounted to L.32,323. It is a corporate town, governed by two bailiffs chosen annually, a recorder, two chamberlains, two coroners, and twenty-four common councilmen. It returns two members to parliament, chosen by the freemen; and has an admiralty jurisdiction on the Essex coast beyond Harwich, and on the Suffolk coast to the boundary of the county. The population amounted in 1801 to 11,297, in 1811 to 13,670, in 1821 to 17,186, and in 1831 to 20,454.

IRAK, a province of Persia, being the greatest part of the ancient Media, is bounded on the south by Fars and Kuzistan; on the east by Khorassan and the great salt desert; on the west by Kurdistan; and on the north by Azerbijan, Ghilan, and Mazunderan. This great province has everywhere a most mountainous appearance. The mountains are barren and devoid of timber, and run generally from west to east, enclosing valleys from ten to fifteen miles in breadth. They either gradually sink into the desert, or throw out branches into the provinces of Kerman and Khorassan. The valleys are for the most part uncultivated, excepting in the vicinity of the villages. The land, however, is good, and is capable of yielding abundance of corn. But the country languishes under oppression, by which the valleys that were once productive are now rendered desolate; and the cities and aqueducts, which were formerly in a different condition, are now ruined. This province is divided into five great districts, and each of these into lesser districts. There are, 1*st*, Ispahan; 2*d*, Teheran; 3*d*, Naen; 4*th*, Mullager; 5*th*, Kermanshaw. A lofty range of mountains divides the northern frontier of Irak from the provinces bordering on the Caspian Sea. This range passes about six miles to the north of Teheran, and, about fifty to the east, suddenly advances to the south as far as latitude 36° north, and again as suddenly retiring, forms a point, at the extremity of which is the Pass of Khawar, designated in ancient geography by the appellation of the Caspian Gate. Some of the plains in this province afford excellent pasturage, and are populous and well cultivated, while others are almost in a state of nature. Towards the south-west, near the mountains of Louristan, the high country is diversified with rich valleys, inhabited by the tribes of Fity and Bucktiari; and the southern division of the district of Ispahan, lying between that capital and the towns of Yezdikhaust and Isferjan, is more populous than the neighbouring district of Fars, and is just recovering from the deplorable state to which it had been reduced by the ravages of the Afghans. The valleys are all connected with each other, either by openings in the mountains, or narrow defiles. The villages have a picturesque and flourishing appearance; and the produce of the district is not inferior to that of the most fertile spots in Persia. It is about seventy miles in length and forty in breadth, and is irrigated by canals cut from the Zeinderood, which are surrounded with gardens and a prodigious number of pigeon-houses. These animals are kept principally for the sake of their dung, which is a rich manure, and is supposed to give to the melons of Ispahan their acknowledged superiority in flavour to all others. The largest of these pigeon-towers sells for about L.3000. The most arid part of Irak is that situated between this city and Yezd. The soil is poor, and light, and sandy. A general scarcity of wood and water prevails; and the climate is hot, though not unhealthy. The climate of Irak towards the north is delightful in the spring, though rather cold towards its commencement, as the snow is scarcely off the ground, and a keen north wind blows from the mountains. The heat sets in towards the middle of June, and continues to increase till the middle of August, when the harvest is collected. Snow begins to fall in the end of September, and continues to fall in great quantities during the months of December, January, and February. In the province of Irak is the high land which divides the streams that flow northward into the Caspian Sea from those which flow southward; namely, the tributary waters of the Tigris, or the Shut-ul-Arab, and their head branches, one of which, the Zeinderood, passes through the city of Ispahan. Within the limits of this province are comprehended many great and celebrated cities, the largest of which is Ispahan, for many ages the capital of the Persian monarchy; Yezd, which is large and populous; Natunz; Cashan, a flourishing city; Koom; Teheran, the present capital of Persia; Casween, a commercial and populous city; Sultanea, now in ruins; Zinjan, a prosperous town; Hamadan, supposed to be the ancient Ecbatana; Kermanshaw, and others.

IRASCIBLE, in the old philosophy, a term applied to an appetite or a part of the soul, where anger and the other passions which animate us against things difficult or odious were supposed to reside.

Of the eleven kinds of passions attributed to the soul, philosophers ascribe five to the irascible appetite, viz. wrath, boldness, fear, hope, and despair; the other six being charged on the concupiscible appetite, viz. pleasure, pain, desire, aversion, love, and hatred.

IRBIT, or Irbitskaia, a town of Russia, in the government of Perm, on the river Irbit, and the frontiers of Siberia. It is noted for a yearly market held in January, the season for travelling on the ice, and is an entrepôt for Siberian furs, and other arctic merchandise passing into Europe. The annual fair is frequented by Russians and Siberians, Tartars, Armenians, and Greeks. Near it is a large iron work, which yields nearly 2000 tons of iron a year. It is 142 miles north-east of Ekaterinenburg. Long. 62. 50. E. Lat. 57. 35. N.

IREG, a market-town of the circle of Sezerem, in the Austrian Sclavonian province of Siebenbirgen. It stands at the foot of the Karlovitz Mountains, in a fruitful district yielding good wine. It contains 1020 houses, with 4863 inhabitants. Long. 19. 47. 59. E. Lat. 45. 6. 47. N.

IRELAND.

Ireland, one of the largest of the European islands, is situated to the west of Great Britain, from which it is separated by a narrow channel called the Irish Sea and St George's Channel on the east, and is bounded on its other sides by the Atlantic Ocean, through which it can maintain a direct communication with the continents of Europe, Africa, and America. The advantageous position, the fertility of the soil, and the salubrity of the climate, have conferred upon Ireland commercial facilities, which are capable of being greatly increased. How far these natural advantages have been made available towards the internal improvement of the island itself, and the general benefit of the empire of which it forms an important part, may be best ascertained from the following details of its history and statistics.

HISTORY.

The Irish nation is undoubtedly of Celtic origin. This truth is stamped in indelible characters in the names of the rivers, towns, mountains, and other objects of historical notoriety throughout the island; it is proclaimed by marks equally indelible in the relics of antiquity, the tumuli, the cairns, the cromleachs, and the druidical circles, the remains of which, after having triumphed over the ravages of time and repeated revolutions, are now perpetuated in the pages of the antiquary's researches. The name of the island itself confirms the assertion. Eri or Erin, its most ancient appellation, and that to which the natives still cling with the attachment of veneration, is derived from the Celtic Iar or Eir, which signifies western. Most of its more modern names may be easily traced to this source. By the Grecians, to whom, though unacquainted with its localities, its general geographical position and bearings were not unknown, it was called Ierna, being honoured by them with the rank of the third of the islands of the ocean, and yielding precedence in this respect only to Taprobane and Britain. Ptolemy names it Iouerna; Juvenal and Mela, Iuverna. Diodorus Siculus, approaching more nearly to the aboriginal word, calls it Iris. Marcianus Heracleota and Eustathius adopt the term used by Ptolemy, but corrupted by the latter into Bernia. By the Britons it was called Iverdon; and the Saxons, attaching to the native name an epithet from their own language, called it Ierland or Ireland. Its later name, Hibernia, may be traced somewhat more circuitously to the same source, although much etymological and antiquarian ingenuity has been employed to deduce it from other circumstances. Some choose to derive it from its climate, calling it Hibernus, on account of its wintry temperature, as unjustly in fact as erroneously in etymology; others from Iberus, a Spaniard, or a river of Spain. One writer ventures still further. Postellus, in his strictures on Mela, deduces it from the Hebrew, "Irin quasi Iurin," the land of the Hebrews, "who, knowing that the empire of the world would be established in a very strong corner to the north-west, made themselves masters as soon as possible of those parts, and of Ireland." Bochart traces it to the Phœnician; Hibernia, according to him, or Ierne, being nothing more than Ibernæ, or the furthest habitation, because, beyond Ireland westward, all was ocean, according to the ancients. This derivation may be easily made to harmonize with that deduced from the Celtic, serving also to corroborate the opinion now very generally entertained, that the Celtic Irish and the Phœnician were kindred branches from the same eastern stem. Another name from another source has been fixed upon Ireland, one of different derivation, and of later acceptation, as not being known until the fourth century after Christ, when the country was generally designated throughout the learned world of that day by the name of Scotia. Some writers take the word to be a corruption of Scythia, from which region they suppose the nation to have emigrated; others, amongst whom are Whitaker and Chalmers, assert that the people acquired this name from their habits of roving and spirit of enterprise; the term "sceite," according to them, signifying dispersed or scattered. The name of Ogygia has also been applied to it, and adopted by O'Flaherty in his *Chronological Annals*. Certainly, if the Ogygia, which Plutarch places west of Britain, be any thing more than an imaginary formation, it must signify Ireland. Yet if so, it should more properly be considered as an epithet given to it on account of its antiquity than as a proper name; the Greeks applying that word exclusively to what was of an origin beyond existing records.

A recurrence to the Greek and Roman writers will show that the country thus designated was not considered by them as the habitation of a single nation. On the contrary, its coasts are described by Ptolemy as being possessed by a number of tribes of various names; whilst with the interior he seems to have had no acquaintance. His nomenclature has been followed by succeeding geographers, with little variation. According to these authorities, the northern regions were possessed by the Venicnii and the Robogdii; the eastern by the Darnii or Darini, the Voluntii, the Blanii or Eblanii, the Cauci, the Menapii, and the Coriondi; the southern shores were possessed by the Brigantes, the Vodii, the Uterni or Ivernii, and the Vellebori; the western coast was the residence of the Gangani or Cancani, the Auteri, the Nagnatæ, and the Herdini or Herpeditani. Whitaker supposes the interior, comprehending all the inland counties, to have been peopled by a tribe which he calls the Scoti.

The native annalists present a very different picture of the ancient state of the country, which, although much disfigured by the fables of romance with which the bards, the only historians of the time, chose, for very obvious reasons, to embellish their narratives, must be supposed to rest upon a groundwork of reality. Rejecting, therefore, from their accounts what is evidently fabulous, and suspending the judgment as to circumstances of doubtful or obscure character, the temperate investigator of truth will be able to trace a series of historical connections, to which assent may be conceded, at least to the same extent as to those parts of the recognised histories of other countries, in which it is acknowledged that truth verges upon fiction. With this clue to the investigation of a train of occurrences which affect to penetrate further into the darkness of antiquity than those of any other nation, except the Jewish, the investigation of the history of Ireland may be ventured on from the earliest period at which the most enthusiastic advocate of its primeval origin thinks himself justified in fixing his first footsteps, until we arrive, through the periods of doubt, at those of undisputed historical certainty in our own times.

According to the native historians, Partholan, the sixth in descent from Magog, Noah's second son, settled in Ireland at the head of a thousand men, and took possession of a country in which no one appeared to dispute his right of occupancy. But he did not long enjoy his possession of it in tranquillity; for at the same time, or shortly afterwards, there arrived a band of lawless adventurers, of the stock of Nimrod, the descendant of Ham, who were distinguished by the name of Fomorians, or Fawmorries, a name still applied to strangers by the native Irish. With these took place a series of deadly hostilities, which terminated in a battle so bloody and so decisive, that not a single stranger was left alive; and the ground was so infected with the putrefying corpses, which the residue of the followers of Partholan were now too few and weak to inter, that a plague broke out, which destroyed all the survivors, and left the country totally uninhabited for thirty years.

At the termination of this period, Nemedius, another descendant of Japhet, made a settlement on the island with a thousand men, from the borders of the Euxine. The tranquillity of his settlement was also disturbed by the incursions of tribes of Fomorians, here said to be African pirates, with whom his followers carried on an incessant warfare, but with different ultimate success; for the strangers, being reinforced with fresh supplies from their own countrymen, at length defeated the Nemedians with such slaughter, as to force the scanty remains of this second colony to return to the country whence they had originally emigrated. They took their departure in three companies. The first, under Breac, proceeded to Thrace, where they took the name of Belgæ; the second, under Jobath, proceeded no farther than Bœotia; and the third, under Bridtan, repaired to the neighbouring island of Britain, where they formed the tribe of the Brigantes. From this Bridtan, the Psalter of Cashel, a record of great authority in the first and second ages of the Irish, traces the origin of the Welsh.

The Fomorians, when sole masters of the country, went to war amongst themselves, and carried their dissensions to such a height of animosity, that the island was a second time utterly depopulated, and continued so until some of the descendants of the Thracian Nemedians, to the number of about five thousand men, returned thither, under the command of the five sons of Dela. The Irish annalists distinguish this colony by the name of Fir-bolgs; a name said to be applied to tribes living in caves, whither the natives used to have recourse for shelter in cases of extremity. To this colony is attributed the division of the country into five principalities, which continued, though not without interruption, till the English invasion. The names of the states of the pentarchy were, Leinster, Munster, Ulster, Connaught, and Meath. The principal chieftain of each division was honoured with the title of king, a name applied very liberally at all times to the petty dynasts who arrogated supreme authority over their own territories, however limited; but the ruler over Leinster was recognised as sovereign, to whom submission was tendered, and from whom protection was claimed, by the other members of the pentarchy in cases of danger. This system of government continued undisturbed for eighty years, through a succession of nine sovereign rulers, when it was broken in upon by the intrusion of another colony of the same stock, called by the Irish writers Tuatha-na-Danans; a name said by some to have been given them as being the descendants of the three sons of Danan, a profound adept in the art of magic, and by others, as being divided into the three tribes of Tuatha or commanders, Dee, druids or priests, and Danan or bards. The chronicles of the time state, that having been driven out of Bœotia by their inveterate enemies the Fomorians, after wandering through various countries, they settled in Norway, where they were hospitably received; whence they removed to Scotland, and, after a residence there of seven years, proceeded to Ireland, carrying with them several necromantic curiosities, the most remarkable of which was the fatal stone, or stone of destiny, to which tradition attached the belief that the sovereignty would remain with that nation whose king was crowned upon it. The tale would be unworthy of historical notice, were not an observance of the present day connected with the superstitious credence to which it owes its birth. The stone, after having been preserved for many generations in the line of the Irish Milesian monarchs, was taken to Scotland by a king of that family, by whom it was fraudulently detained, and used as the inauguration stone of the Scottish kings until the time of Edward I. of England, who, on his conquest of the country, transferred it, together with all the other appendages of royalty, to London, where it is still kept, under the name of Jacob's stone, and is used in the ceremonial of the coronation of the kings of Great Britain. The Belgæ defended themselves for some time with great spirit, but they were at length totally defeated. Numbers of them withdrew to the neighbouring islands and coasts of Scotland; and those who remained were reduced to a state of abject slavery, under which they remained during the whole time their enemies held the dominion, which the latter were enabled to do, without molestation from a foreign enemy, for an hundred and ninety-seven years, under a succession of nine sovereigns.

The dynasty of the Tuatha-na-Danans was terminated by an event similar to those which had extinguished the two previous colonies. An expedition from Spain, under the eight sons of Milesius, landed in the south-west of Ireland, and after encountering many perils, partly by the violence of a storm, by which five of the leaders were lost, partly by the resistance of the old settlers, they obtained possession of the entire country, which was divided between Heremon and Heber, two of the surviving sons of Milesius; Amergin, the third, having no share in the government, but acting rather as a councillor to both, a function which his literary acquirements entitled him to assume. The southern part fell to Heber; Leinster and Connaught to Heremon, who fixed his residence at Teamor, now called Tarah, in Meath. A war soon broke out between the brothers, which was terminated by the total defeat of Heber, the aggressor, who was killed in a battle fought at Geisiol, or Geashil, in the King's County. But his death did not put an end to the domestic dissensions of the family. A few years after, Heremon put his remaining brother to death, and thus obtained the sole dominion, which he held for thirteen years, till his death. His time was chiefly employed in repelling invasions of the Britons and of the Picts. The government then continued through a race of twenty kings of the same family, of whom nothing worthy of mention is recorded; the annals of the period containing merely the intestine dissensions of the chiefs of the several branches, and their wars with the Britons and Picts, until the crown descended to Ollav Fola, of the family of Ir, one of the sons of Milesius who had perished on the first landing in Ireland. During his reign, which commenced about 900 years before Christ, the Fez, or triennial meeting of the subordinate chieftains, priests, historiographers, and bards, was instituted at Teamor, or Tarah, in which, besides the regulation of all matters affecting the government and the enacting of laws, a minute investigation was entered into of the national monuments and records. Whatever was then deemed genuine and authentic, was inserted in a volume called the Psalter of Tarah. This legislator closed a reign of forty years, spent with benefit to his subjects and honour to himself, by a natural death, a circumstance very unusual in the annals of those times, and left the undisputed succession to his son, who enjoyed it for seventeen years, and also had the unusual good fortune to die in the same manner. The annals of the succeeding monarchs, for the space of 260 years, present nothing but a reiteration of war and mutual destruction, to such an extent, that out of thirty-one kings, who held the reins of government during that period, all but three are recorded to have fallen in battle, or by a violent death. The only occurrences worthy of notice that can be gleaned from the history of this barren period, are, the erection of a mint, the formation of a standing army by the allowance of a fixed pay to the soldiery, and the invention of the small boats, formed of wicker-work and covered with hides, now called corraghs.

Kimbath, who ascended the throne 460 years before Christ, has obtained an honourable celebrity by his efforts to revive and improve the institutions of Ollav Fola. He formed a national police, and regulated the artificers and tradesmen, whom he placed under the jurisdiction of a council of sixty of the nobles and learned men, without whose license no person was permitted to practise any mechanic art. The foundation of the royal palace of Eamania, near Armagh, is attributed by some writers to him; whilst others give the credit of it to his widow, who succeeded him, and reigned seven years, when she was cut off by her successor, who in his turn fell by the hand of Hugony the Great, in revenge for the death of his foster mother. This last-named monarch, with whom the line of Heremon would have terminated had he died without issue, was married to the daughter of a king of France, and kept possession of the crown during a vigorous and active reign of thirty years. He obliged the Picts to pay tribute, and extended his dominion over the Western Isles. He also abolished the pentarchical form of government, dividing the country into twenty-five provinces, over each of which he placed one of his twenty-five sons, and causing the public revenues to be collected according to this arrangement. But neither his virtues nor his abilities were sufficient to save him from the usual fate of Irish monarchs, nor to prevent the recurrence of acts of slaughter amongst his posterity. He was slain, after a reign of thirty years, by his own brother, who fell by the hand of one of Hugony's sons, who in his turn perished by the treachery of his only brother. Amongst the successors of Hugony, Eochy, surnamed Feileagh, or the Melancholy, has made his reign memorable by founding the royal seat of Croghan, in Connaught. It is also celebrated as being the era of the red-branch knights of Ulster, who were said to have had a residence at the palace of Eamania. His successor Eochy introduced the custom of burying in graves instead of burning. Conary More, who reigned for thirty years according to some writers, and sixty according to others, is famous for having enjoyed the longest, happiest, and most tranquil reign in Irish history. Such periods are not those which furnish most materials for the annalist. Of the particulars of his life, though so highly celebrated, little is recorded. He was killed in battle by the king of Wales, though other accounts state that he was treacherously burned in his own palace of Teamor, which also became a prey to the flames. In the reign of Crimthan, one of his successors, who had married the daughter of a Pictish chieftain, the Irish were the auxiliaries of the Picts against the Romans. The information of the leader of a rival faction to this prince is said to have induced Agricola to entertain the idea of conquering the island with a single legion and some auxiliaries. Whatever might have been the result of such an invasion under a general of acknowledged military talents, it is certain that the Roman power in Britain declined so rapidly from this time, that the Irish made frequent irruptions into the Roman province, and returned to their own country loaded with spoil. Feredach, one of the successors of Crimthan, owes his title of the Just to his chief councillor Moran, whose rigid impartiality in the dispensation of justice is recorded, in the figurative language of the bards, under the allegory of a collar, invented and handed down by him to his successors in office, which had the supernatural effect of pressing upon the neck of the wearer in case his decision deviated from the strict rule of equity, so as to strangle him if he persevered in his iniquity. Feredach was killed after an unsettled reign of seven years, by an insurrection of the peasantry, to whom the name of Attacots was given; a name which afterwards was carried into North Britain, where, though at first applied to disturbers of the public peace, it ultimately became the distinguishing title of a tribe inhabiting the country adjoining the Roman wall. After a period of civil commotion, Tuathal, upon attaining the sovereign power, exerted himself to restore the ancient constitution of Ollav Fola, and the pentarchical division of the country. To him is attributed the appropriation of the central province of Meath, as a demesne or mensal land for the supreme monarch. Here he restored the royal residence, and founded an edifice for the sacred fire, to which the Druids and priests were to have recourse on the last day of October, to perform a solemn sacrifice, and to supply fire to all the people, who were bound to extinguish their usual fires at that time, and to relight them from this hallowed source. He built similar palaces and temples at Uisneacht in Connaught, at Flaodha in Munster, and at Tailtean in Ulster, where there was a fair, to which parents brought their grown-up children and contracted them in marriage. He also was the originator of the fine afterwards known by the name of the Boromé, or Leinster tribute, imposed upon the king of that province for having caused the death of two daughters of Tuathal, whom he inveigled away under a treacherous promise of marriage. This monarch died in battle. The reign of Conn Keadcahagh, or Conn of the Hundred Battles, is best known by the division of Ireland which he was compelled to make with Mogha Nuod, king of Munster. The line of demarcation was fixed by a rampart and fosse, extending across Ireland from Dublin to Galway, the country to the south of which was called Leagh Mogha, or Mogha's share, that to the north Leagh Cuin, or Conn's share; names still familiar amongst the Irish. Cormac, the grandson of Conn of the Hundred Battles, signalized himself by his efforts to restore the ancient regulations of the monarchy; but having lost an eye in suppressing a rebellion excited by one of his own family, and being thus excluded from the throne through the prevalence of a prejudice which forbade a mutilated person to continue monarch, he closed his life in retirement, during which he drew up a treatise, yet extant, called the Book of Advice to Kings; a work extolled by the native writers as worthy to be written in letters of gold, a perfect standard of policy to all ages. In his reign flourished the celebrated Irish militia, known by the name of Fiana Erion, and commanded by Fein M'Cooil, commonly called Fingal. It was a military association, into which admission was attainable only by convincing testimonies of great strength, activity, and intelligence; besides which, an engagement was required on the part of the newly-admitted member to choose a wife solely for her merits, never to ill-treat a woman, and not to turn his back upon an enemy, even though nine times as numerous as the body to which he belonged. The regular number of this force was said to be nine thousand men, divided into three battalions. After a variety of exploits, which have furnished materials to much of the legendary romance of the time, the body was annihilated during the succeeding reign, at the battle of Gabra or Gawra, in Meath, where Oscar, the son of Ossian the poet, fell. Passing over a series of several kings known only by name, Nial of the Nine Hostages signalized himself by his military expeditions in Scotland, England, and France. His career of conquest was cut short in the last-named country, where he died of the wound of an arrow treacherously discharged against him on the banks of the Loire. His immediate successor, Dahy, met with an untimely fate in the same country by lightning. He was the last pagan king of Ireland. In the third year of Logary, or

Lae-ra, who succeeded Dahy, Palladius arrived in Ireland, being sent on a mission thither by Pope Celestine for the conversion of the natives. He was not, however, the first who had been thus employed. The names of St Albe, Declan, Iber, and Kirian, are quoted as his predecessors in the pious work. But their labours were confined to particular districts, nor does it appear that they acted under the authority of the see of Rome. Either through ignorance of the language, or want of spirit to withstand the ferocious opposition of his pagan adversaries, Palladius was compelled, after having founded three churches, to relinquish the design, and to quit the country, in order to save his own life and those of his followers; but he was prevented by death from returning to Rome to give an account of his mission. The completion of the work so inauspiciously commenced was reserved for St Patrick, whose success has acquired him the title of the apostle of Ireland. He was a native of North Britain. When sixteen years old he was brought prisoner to Ireland by Nial of the Nine Hostages, during one of his foreign expeditions, and spent seven years in slavery in the country, where his employment was the herding of swine. The law of bondage at that time extended no longer than the seventh year, at the expiration of which time he returned to his native country; and, after having studied under his uncle, the Bishop of Tours, he found his way to Rome, where he was selected by the pope to renew the attempt which had already failed; an undertaking for which his knowledge of the language, acquired during his captivity, peculiarly qualified him. To Ireland, therefore, he proceeded with twenty disciples or assistants, which number was increased to thirty-four in England, where he touched during his voyage. His first reception on his landing at Wicklow was very discouraging. The report of his arrival had already reached the Pagan prince who had expelled his predecessor. The same spirit of hostility was directed against the new comer, and Patrick and his company were assailed and forced to take refuge on board their ships. But, though discouraged, he was not disheartened. Instead of relinquishing his purpose, he proceeded to the island afterwards named Holm-patrick, where, having refreshed himself by a short leisure, he proceeded to Ulster, and preached before the chieftain of the district so forcibly as to convert him and his family, and to obtain license to found a church there. In the second year of his mission he presented himself before the Fez, or council at Tarah, where he proved equally successful; Logary the king declaring himself a convert, and many of his subjects following his example. Nor does it appear that the subsequent progress of the apostle was checked by any untoward circumstance. The remainder of his life, which was protracted to an unusual length, was spent in traversing the country, spreading around a knowledge of the Christian doctrine, gaining over converts, and founding churches and monasteries. The chief of his religious foundations was at Armagh, which soon became a school of theology, so famous that students flocked to it from all quarters in such numbers, that at one time it was said to have communicated instruction to seven thousand students. The exertions of Patrick were not wholly confined to the preaching of the gospel. He gave his advice and assistance in the reformation of the government. At his suggestion, Logary summoned an assembly of the princes, historians, and antiquaries, to revise the records and chronicles of the country; and their amendments were deposited in the public archives, under the name of "The Great Antiquity." Fragments of copies taken from this work were to be met with for many centuries afterwards, under the names of the Book of Armagh, the Psalter of Cashel, the Book of Glandaloch, the Leabhar Gabala, and others, from which subsequent writers have derived much of their information respecting the ancient history of the country. Patrick did not retain the government of the bishopric erected by himself in Armagh; but having appointed Binen or Benignus his successor in the see, and having made a visit to Rome, he spent the remainder of his life chiefly at Saul, near Downpatrick, where he had founded a monastery, in which he closed a career of active and successful labours, in the hundred and twentieth year of his age, and was buried in the neighbouring abbey of Downpatrick.

Although the exertions of St Patrick produced an effect so great upon the public mind, that, for many years after, the founding of religious institutions, and the lives and deaths of the ecclesiastics engaged in maintaining and extending the new faith, formed the chief subjects of history, it does not appear that the change of religion produced the beneficial alterations that might have been hoped for from it on the political aspect of affairs. The brief notices of the civil occurrences continue to exhibit little more than a reiteration of the turbulence, crime, and desolation, that had marked the era of paganism. The only event of importance that diversifies the tissue of domestic and foreign warfare which forms the subject of the annals of those days, occurred during the reign of Hugh, the son of Ainmireagh, in which an assemblage was convened at Drumkeath, in Derry, for the express purpose of curbing the license of the bards, now become intolerable. The privileges annexed of old to this order, whose properties as well as persons were inviolable in all civil commotions, whose lands were freed from tribute, and whose houses were respected as sanctuaries, had rendered the numbers of the profession so great, and entailed such a burden on the state for their support, that they were several times before about to be banished from the country. At the assembly now held, they found a zealous and useful friend in the celebrated Columbkill, who left his monastery of Iona to be present here, and prevailed so far as to procure a mitigation of their treatment, by changing the decree for their banishment into one for the diminution of their numbers. It was therefore resolved, that in future the king of Ireland, each provincial sovereign, and the lord of every subordinate territory, was to maintain a bard to preserve the genealogies and record the acts of the respective families; and that a suitable salary was to be allowed him, in return for which he was also to instruct the youth in history, poetry, and antiquities. The whole body was placed under the control of an arch-poet, in whom was vested the power of admitting qualified persons. Thus restrained as to numbers and means of acquiring wealth, their properties were as hitherto exempted from taxation, and their persons privileged. Yet, during this gloomy period, in which the internal state of the country exhibits so little to cheer the inquirer, it became celebrated throughout Christendom, on account of the piety and learning of the inmates of its religious establishments. In the fifth century Sedulius made himself known as a poet, an orator, and a divine, and spread a knowledge of his acquirements, and the fame of the country in which he had imbibed them, through France, Italy, and the western regions of Asia. Columbkill, already transiently noticed as the founder of the monastery of Iona or Hy, the burial-place of the Scottish kings, adorned the sixth century. So also did Congall, the founder of the monastery of Bangor, famed for the multitude of religious men whom its learning and the strictness of its rules led to it. In the seventh century flourished Columba, the founder of several monastic institutions in France and Italy; Aidàn, to whom the conversion of the Northumbrians is attributed; Finan, who followed him in the same field of missionary labour; Argobast, who preached in Alsace, and was thence raised to the see of Strasburg; Adamnanus, who visited the court of Alfred, king of Northumberland; and Cuthbert, the son of one of the petty kings of Ireland, who, after having been prevailed on with much difficulty to take charge of the bishopric of Holy Island, in the same part of England, resigned it for a life of studious retirement in the Isle of Farn, where he closed his life. In the eighth century lived Sedulius the younger, who assisted at a council held at Rome by Gregory II., and was afterwards a bishop in Spain; also Vergilius, a philosopher as well as a divine, as appears by a treatise of his on the Antipodes, written against the then received opinion of the shape of the earth, which he proved to be a globe, and not a plain surrounded by the heavens at its verge. He spent some time in France at the court of King Pepin, by whom he was highly esteemed.

The state of Ireland was now destined to suffer from another element of convulsion. About the commencement of the ninth century, the Danes began to extend to it their predatory ravages. Their first attacks were trifling and occasional, more of the nature of piratical incursions than preconcerted invasion. But in proportion as the success of their first assaults rendered them more daring, and their more extended knowledge of the country made them better acquainted with its fertility, their bands became more numerous, and better prepared for continued hostilities; whilst at the same time the unsettled state of the country, caused by the intestine wars of the native princes, carried on either for the purpose of attaining the supremacy, or for exacting tribute from their inferiors, prevented that combination of defence which alone could ensure success against the foreign enemy. In the middle of the same century, Turgesius, king of Norway, had virtually rendered himself monarch over the greater part of the island. He maintained himself in it with all the cruelty and arrogance of an usurper. Danes were placed in all the subordinate kingdoms. Every district had a Danish officer placed over it, and even every house was required to maintain a Danish soldier. The use of arms was prohibited to the Irish. A tribute of an ounce of gold was exacted from every householder, the non-payment of which was punished by the mutilation of the nose, whence the tribute was known by the name of the nose-tax; and, to complete the climax of degrading submission, the bridal favours of new-married virgins were exacted by the Danish chief of the territory, and were sometimes commuted, at his caprice, for a sum of money. The country had groaned for thirteen years under this complication of insult and injury, until it was at length roused to shake off the degrading yoke. Turgesius had erected a rath for his residence in the neighbourhood of Tarah, where lived Malachy, who still retained the title of king among the Irish. Turgesius claimed his daughter. Malachy, conscious of his inability to resist the demand openly, yet unwilling to sacrifice his only child without an effort, sent along with her a number of young men disguised as her female attendants, who fell upon the Danes in the rath, slaughtered them, seized Turgesius, and handed him over bound to Malachy, who had advanced with a band of armed men to their aid. The captivity of the tyrant was the signal for a general insurrection of the Irish, by which the Danes were forced either to fly aboard their shipping, or to take refuge in the maritime towns that acknowledged their authority. Turgesius, after being kept some time in prison, was drowned in Lough Innel. On the expulsion of the Danes, the country reverted to its former state of internal dissension. Cormac M'Cuillenan, king of Munster and bishop of Cashel, an union of civil and spiritual jurisdiction then not uncommon, claimed a tribute from the king of Leinster, which, on refusal of payment, he proceeded to enforce by the power of his arms. But on entering his adversary's territory, he found him strengthened by the support of the king of Ireland. The unexpected intelligence threw such a damp upon the spirits of his troops, that many deserted him before the battle: those who stood firm were soon routed, and Cormac himself was killed by a fall from his horse, whilst endeavouring to escape amongst the fugitives. This king is best known in history as the compiler of a book of annals, called the Psalter of Cashel, from which succeeding writers derived much information. It has been many years lost.

The internal dissensions of the country encouraged the Danes to make another effort for subjugating the island. A large force landed in Leinster, under the command of Setrick, said by some writers to have been a son of Turgesius, by whom Dublin was taken, and the possession of it secured by a signal victory obtained over the combined forces of the Irish, in which Nial, king of Ireland, and many of his generals, fell. The distractions of the country, thus augmented by the presence of a foreign enemy, obtained a temporary intermission by the accession of Brian Boree to the sovereignty. This prince, the great hero of the Irish, was brother to the king of Munster, on whose death he succeeded to the throne of that province, from which he not only expelled the Danes, who had made a settlement in Limerick, but extended his dominion over the whole southern division of Ireland. The brilliancy of his achievements against the common enemy induced the rest of the subordinate chieftains to unite in a confederacy for deposing Malachy, the reigning monarch, and raising Brian into his place. The object was effected with little difficulty, and, what was more unusual in the revolutions of the country, with no bloodshed. Malachy was of a mild and undecided character. After a feeble effort to revive the spirit of loyalty among the subordinate princes of the northern division, to the chief of whom, O'Neill, he offered a large portion of his dominions, he resigned the crown without a struggle. The new monarch was publicly proclaimed and inaugurated at Tarah. After receiving the submissions of the kings of Ulster and Connaught, and reducing some refractory chieftains who disputed his authority, he directed the combined energies of all the states against the Danes, whom he expelled from the island, with the exception of such as consented to embrace Christianity. These he located in the great seaports of Dublin, Wexford, Waterford, Limerick, and Cork. Having thus removed the obstacles arising from a foreign enemy, he directed his attention to the general civilization of the kingdom, by founding or restoring the places of worship and seminaries of education, building bridges, opening passes, erecting fortresses, and fitting out a fleet to oppose the Danes on their own element, before they could effect a landing. In the accomplishing of these objects, he spent the latter part of a long and glorious reign. But its termination was marked by a circumstance that undid all his labours. The subordinate king of Leinster, irritated at an insult offered to him in the court of Brian, made overtures to the king of Denmark for a union to expel him from the throne. These were gladly accepted. A large fleet was sent from Denmark, which landed a body of troops near Dublin, where they were joined by those of the king of Leinster. Brian was not negligent in discovering, or tardy in adopting measures to resist, this new combination. At the head of a numerous and well-appointed army, collected from all the other provinces, he marched to meet the enemy. The battle was fought on the plains of Clontarf. It was bloody and desperate, but decisive; the Danes were utterly defeated, and forced to fly to their ships. The Leinster men, abandoned by their foreign friends, were cut to pieces without mercy. The exultation of triumph would have been as unmixed as the victory was glorious, had it not been clouded by the death of the monarch, who, though too far advanced in years to take part in the engagement, led the army to the field, and was killed in his tent, whither he had remained during the conflict, by a party of straggling Danes, as they

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were flying. His eldest son Mortogh fell in the battle. Malachy, the deposed monarch, seized the opportunity of reviving his claim to the vacant throne. His conduct during the late crisis had been more than dubious. He had made a show of assisting the Irish with the forces of Meath, which province he had been allowed to retain, but, on the commencement of the battle, withdrew his men to a neighbouring eminence, where he continued an inactive spectator of the struggle. His claim was acquiesced in. But his resumption of the reins of authority proved only the signal for the renewal of those scenes of turbulence and anarchy which the commanding talents of his predecessor had kept under control. The apprehensions of subjugation to a foreign power were indeed removed. The victory of Clontarf discouraged any further effort of the Danes, whom alone the native rulers dreaded. These were left to carry on undisturbed their schemes of self-aggrandizement and mutual contention. The only event to diversify the gloomy monotony of incessant civil discord, was a synod of the clergy at Kells, held in 1152, under Cardinal Papiron, the pope's legate. Heretofore the connection of the Irish church with the see of Rome had been very slight, and altogether voluntary. It was governed by the two Archbishops of Armagh and Cashel, and a number of bishops, whose system of control was regulated by domestic synods. At the assemblage now spoken of, the supremacy of the see of Rome was acknowledged, and four palls were given to the Archbishops of Armagh, Cashel, Dublin, and Tuam.

Things continued in this state till the time of Roderic Connor, whose reign forms the commencement of a new era, which overthrew all the ancient forms and constitutions of government, and gave to the tide of political events a new turn, by which they have been influenced to the present time. Notwithstanding the proximity of England to Ireland, there had hitherto been but little intercourse between the two countries. Wales, then an independent state, interposed between them. The Saxons were not a people of commercial or adventuring enterprise; and, even after the final consolidation of England into an established monarchy under the Normans, the views of the monarchs of this line, whether for extension of territory or for commerce, were directed towards the states of the Continent, whence they had derived their parentage. We read indeed of an invasion, and even a subjugation of part of Ireland, by Edgar, king of the Northumbrians. If such occurred, it has left behind it few or no historical traces. The episcopal see of Dublin acknowledged the supremacy of that of Canterbury, from which it received its canons and rights of ordination. The Danish character of the city, which, until after the English invasion, was always considered as a subordinate seaport, accounts sufficiently for this peculiarity; and that the connection between the two kingdoms had nothing in it savouring of subjection on the part of Ireland at the time now about to be entered upon, appears from the fact, that at the synod of Armagh, assembled in 1170, to inquire into the cause of the arrival of strangers from England for the purpose of conquest, the impending calamity was imputed to the sins of the people, and more especially to the practice of buying English children, and making them slaves. Giraldus Cambrensis, in stating the fact, adds, " that the English, by a common vice of their country, had a custom to sell their children and kinsfolk into Ireland, although not driven to it by extreme poverty."

Dermot M'Murrough, king of Leinster, had incurred the hatred of his own subjects, and of the other princes, by his tyranny. His breach of the laws of hospitality in carrying off the wife of O'Ruark, king of Breffney, gave particular offence to Roderic, by whom he was consequently driven from his dominions. In his distress he had recourse to Henry II. of England, under whom he offered to hold his crown as a tributary, if restored by that monarch's exertions. The offer was very grateful to Henry. He had long before turned his thoughts to the acquisition of Ireland. As early as the year 1154, he had procured a bull from Adrian, who owed his elevation to the papacy to Henry's influence, conferring on him the sovereignty of the island, in order to its civilization, upon payment of the tribute of Peter's pence to the court of Rome. But his domestic difficulties and continental engagements had hitherto obliged him to postpone any active measures to accomplish his object. He was now in Guienne, embarrassed by rebellion amongst his French subjects, and by his disputes with the papal see, and therefore was forced to confine himself to general expressions of assent, confirmed by a permission to all his English subjects to assist in the restoration of his new ally. Supported by this authority, Dermot turned homewards, and, after vainly attempting to engage adventurers in Bristol, he at last formed a treaty with Richard, earl of Pembroke, and Strigul, better known by the name of Strongbow, a Welsh baron, who, having impaired his patrimony, was easily engaged to take part in a desperate enterprise, on the uncertain expectation of inheriting the kingdom of Leinster after Dermot's death, by a marriage with his only daughter, which was to be the reward of his exertions if successful. Through Strongbow's influence, he also engaged the assistance of Robert Fitzstephens, constable of Abertivi, and of Maurice Fitzgerald, a Welsh chieftain. Having secured these auxiliaries, Dermot returned to Ireland, where he lived concealed in the monastery of Ferns, the confidence of whose inmates he had gained by liberal donations to their house, until the arrival of his new friends warranted him in asserting his former station.

Fitzstephens was the first to fulfil his engagement. He landed at the headland of Bag-and-Bon, in the estuary of the Bannow, with a following of but thirty knights, fifty gentlemen, and three hundred archers. Small as the number was, their discipline and superiority in military equipment justified Dermot in throwing off the veil on their appearance. The first movement of the combined force was upon the town of Wexford, a Danish dependency of the crown of Leinster, which surrendered on the first appearance of the enemy, and was, with the two adjoining cantrids of Forth and Bargie, given to Fitzstephens by Dermot, as a foretaste of what was to be hoped for in his service. The next movement was against the king of Ossory, in the Queen's County, who, after a gallant struggle, was also forced to acknowledge the superiority of the Norman mode of warfare. After a hard-fought contest of three days, the passes of his borders were forced, and himself compelled to fly. The news of these successes soon compelled Roderic to take the most decisive measures. At the head of an army collected from all the subordinate provinces, he advanced to drive the rebel king and his foreign auxiliaries into the sea; but the interference of the clergy prevented the appeal to arms. A treaty was concluded, by which Dermot was restored to his former rank, on condition of dismissing his foreign forces, and paying a fine for his outrage against O'Ruark. His son was delivered to Roderic as a hostage, along with others, for the fulfilment of the terms.

The arrival of Maurice Fitzgerald, who landed at Wexford with ten knights, thirty gentlemen, and an hundred archers, gave a new turn to affairs. Fitzstephens, who was then engaged in erecting a fortified post at Carrig, which commanded a pass on the Slaney, near Wexford, resolved to maintain his position. Little influence was necessary to induce Dermot to aid an effort as profitable in expectation as perfidious in act. Encouraged by the hope that this new supply would be the prelude to the influx of fresh bands of well-trained warriors, he indulged in the prospect of gratifying his revenge on the causes of his degradation, and even of seating himself on the throne of supreme sovereignty, through the powerful aid of his English allies. For this purpose, after having reduced the city of Dublin to submission by the devastation of the neighbouring district of Fingal, thus establishing his rule over the whole of his former dominions, he sent to urge Strongbow to hasten his arrival.

This nobleman, not satisfied with the general permission already given by Henry, went to that prince, then in Normandy, and having obtained a vague and equivocal assent, prepared for the vigorous prosecution of his enterprise. He first sent over Raymond le Gros, with a detachment of ten knights and seventy archers; who, landing near Waterford, defeated a body of three thousand Irish, collected from the neighbouring country on the spur of the moment, and maintained his position in an intrenched camp until supported by Strongbow himself, who brought to his relief a body of two hundred horse and upwards of a thousand archers. He then, aided by the junction with Dermot, who had hastened to the place, made himself master of Waterford, and thence proceeded to Dublin, which was taken by assault. Roderic, alarmed at the successes of the English, after having called in vain on Dermot to abide by the late treaty, and having, according to some accounts, beheaded that king's son, in consequence of his father's refusal to fulfil the terms of it, collected another army to oppose the invaders. Dermot's death at this juncture gave a new character to the contest. Strongbow, by his marriage with that prince's only daughter, had succeeded to his royal rights; but being unsupported by any of the Irish chieftains, who viewed with apprehension and envy this intrusion of a stranger, he found himself cooped up in the city of Dublin, with his small band of Englishmen, to stand the brunt of the entire Irish army, with which Roderic had invested the city. But he was delivered from this critical situation by one of those exertions by which a vigorous mind surmounts difficulties. He had been reduced to the necessity of proposing a capitulation. The only terms offered him were the immediate evacuation of the country. Such a surrender of all their brilliant prospects was to these daring adventurers a prospect worse than death. Mito de Cogan, by whose valour in leading the assault the city had been taken, now proposed a sally. His advice was followed. Strongbow, at the head of a select body of ninety knights, attacked the Irish camp. The assault was so sudden and unexpected, that Roderic had scarcely time to escape from the bath, where he was then refreshing himself. The panic spread through all parts; and this great army was dissipated almost without a blow. The English followed up their good fortune by marching to Wexford to relieve Fitzstephens, who was blocked up by the Irish in his castle of Carrig. In the passage thither, the army had to force its way through the passes of Idrone, where O'Ryan, the dynast of the territory, disputed the ground with it successfully, until his death turned the fate of the day. It is said that the English were so severely pressed in the engagement, that Strongbow's son, a lad rising into manhood, fled from the fight, for which he was hewn in two by his indignant father. A mutilated figure on a small monument placed by the side of Strongbow's tomb in Christ Church, Dublin, is still adduced as evidence of the truth of this extraordinary event.

The successes of Strongbow excited the jealousy of Henry, who began to apprehend in them, not the enriching of a subject, whence the monarch might derive honour, but the aggrandizement of a rival in power. He forbade any of his subjects going to the assistance of the English in Ireland, and commanded the immediate return of all those already there. He was, however, appeased by the appearance of Strongbow himself, who surrendered all his possessions in Ireland to the king, to be holden at his good pleasure. He was restored to favour, and appointed seneschal of this new lordship, with the exception of Dublin and the other fortified cities, which the king retained in his own hands. Henry soon afterwards went over to Ireland with a train of 500 knights, and a large body of soldiers. Landing at Waterford, he proceeded without molestation to Dublin, where he received the homage of a numerous assemblage of the native chieftains, whom he entertained in a pavilion hastily constructed of wicker-work without the walls, as the city then contained no building suitable for their accommodation. He also held a great council or parliament at Lismore, in which the English laws were received and sworn to. At the same time a synod of the clergy at Cashel adopted the rules of doctrine and discipline of the English church for their future regulation. After spending the Christmas in Dublin, and dividing the districts that acknowledged his authority among the chief leaders of the adventurers by whose valour they had been acquired, he returned to England early in spring, to allay the commotions which threatened to break out there.

His absence gave rise to dissensions amongst the English leaders, which led to revolt amongst the natives, who had so lately submitted. To aid the efforts of the Irish, Roderic made another attempt to regain his lost dominions, and to expel the strangers. He invaded Meath, which had been given by Henry to an English baron of the name of De Lacy, with such fury, that Raymond le Gros, the favourite general of the English, who was then celebrating his marriage with the sister of Strongbow, was forced to quit Wexford the morning after his nuptials, in order to make head against the Irish. But they, content with the devastation committed in Meath, had already retired across the Shannon, and Raymond turned his arms against Limerick, which city he took by storm with little difficulty. Roderic, convinced of his inability to cope with success against the superior power of England, sent deputies to the king, proposing to do homage, and pay a stipulated tribute, in return for which he was to hold the kingdom of Connaught, and all his other lands and sovereignties, as fully, in other respects, as before the arrival of the English.

On the death of Strongbow, who died and was buried in Dublin, leaving behind him an only daughter, the heiress of his princely domains, the government of Ireland was committed to William Fitz-Andelm, a nobleman allied to Henry by blood; but the complaints arising from his indolent and corrupt administration became at length too loud to remain unnoticed. He was therefore removed, and John, the king's favourite son, was appointed lord of Ireland, at the early age of twelve years. On his arrival at Waterford, at the head of a train of young and arrogant noblemen, the native chieftains hastened to pay their respects and do him homage; but when they approached to testify their allegiance according to the custom of the country, by saluting him with the lip, the prince's English attendants repelled them with insolence, plucked them by their beards, and treated them with every mark of studied indignity. The high-minded natives quitted the court, and their cause was espoused by all who heard their tale. The alarm of war was spread throughout every part of the country. The castles already built by the English on their newly-acquired territories in Meath were stormed and razed, some of their owners killed, and others driven from their settlements. John was recalled, and the government intrusted to De

Lacy, who was soon afterwards assassinated by one of the natives whilst superintending the erection of a fortress which he was building, sacrilegiously, according to the opinion of the times, on the ruins of an abbey dedicated to Columbkill at Durrow. He was succeeded in the government by De Courcy, a nobleman celebrated for his gigantic size and prowess. He had been given such parts of Ulster as he could conquer; and having established his head-quarters at Down, he maintained himself there for some time in a kind of subordinate sovereignty, against all the efforts of the neighbouring princes, and even made an attempt to extend his conquests into Connaught, in doing which, though he failed in the main object of his ambition, he established his power in the neighbourhood of Armagh. The death of Henry II. made no change in the government of Ireland. Richard, intent on his schemes of foreign conquest, permitted John to retain the title and authority conferred on him by his father. The only event which varied the scene of intestine commotion in Ireland during this reign, was the death of Roderic, the last sovereign of all Ireland. The latter years of his life were embittered, in addition to the loss of his independence, by the rebellious conduct of his own sons, which at last compelled him to seek, in the retirement of monastic seclusion, the tranquillity he had vainly sought for on a throne. He died in the monastery of Cong, in 1198, in extreme old age.

John, in the early part of his reign, paid little attention to the affairs of Ireland, which was now much distracted by the feuds carried on between De Lacy, son of him who had been killed at Durrow, and De Courcy. In this struggle the artful management of the former gained him the advantage over De Courcy's blunt and boisterous ferocity. He accused him of having imputed to John the murder of his nephew Arthur, in consequence of which, De Courcy was summoned to the court in London; and when he treated the mandate with contempt, he was treacherously seized by his enemy De Lacy, while performing a religious penance unarmed in the church of Down, and sent prisoner to England, where he was long kept in confinement. A proceeding as unworthy as this which exposed De Courcy to the royal indignation, brought John a second time to Ireland. The lady of William de Braosa, who had received a large grant of land in Thomond, or North Munster, on being required to send her children to the English court as hostages for her husband's allegiance, refused to obey; alleging as a reason, that she would not intrust her children to the care of the murderer of his own nephew. The insult was unpardonable, and John went over in person to avenge it. Upon his arrival in Dublin, upwards of twenty chieftains attended to do homage; but he performed no military act worthy of notice. The unfortunate De Braosa was forced to fly to France, leaving his wife and family behind, who were seized by the tyrant and sent to England, where they died of the severity of their treatment in prison. During his short stay, John paid much attention to the internal management of the country. He ordained that the laws of England should be introduced, with all their judicial forms, a copy of them being left under his great seal, in the exchequer of Dublin. He also divided the districts which acknowledged his authority, and which were afterwards distinguished by the name of the Pale, into the twelve counties of Dublin, Meath, Kildare, Louth, Carlow, Kilkenny, Wexford, Waterford, Cork, Kerry, Tipperary, and Limerick. In the remainder, which comprehended two thirds of the island, the king's supremacy was merely nominal. Connaught, which Roderic in his treaty with Henry had specially reserved to himself, after suffering dreadfully by the contentions of that monarch's sons, and by the irruptions of the English leaders, who endeavoured, by their interference in these family quarrels, to obtain some footing in it for themselves, fell ultimately into the hands of Cathal, surnamed Croove-derg, or the Bloody-handed. But the influence of the De Burghos, a branch of the family of Fitz-Andelm, proved too powerful for him. After many a desperate struggle with the intruders, in which his undisciplined valour enabled him to cope at times successfully with the well-marshalled followers of the English chieftain, he was compelled to surrender two parts of the country to the king of England, in order to secure to himself the peaceable possession of the remainder; at the same time acknowledging himself a vassal, and binding himself to a yearly tribute of an hundred merks. On the departure of John, who continued but a short time in the country, the government was intrusted to John de Grey, bishop of Norwich, who conducted it with prudence and vigour; and afterwards by Henry de Loundres, archbishop of Dublin, the most remarkable act of whose administration was the erection of a castle in Dublin, now the acknowledged capital of the English territory.

Immediately after the accession of Henry III. the Irish transmitted to England a list of the encroachments made on their rights in the preceding reign, with a petition to be taken under the royal protection. Henry sent them in answer a copy of the Magna Charta, whereby they were to be placed on the same footing as English subjects. This charter was confirmed by others of a similar tendency, transmitted by the same monarch. He also gave O'Brien, king of Thomond, a grant of that territory, to be held by English law, in lieu of the Irish tenure by which he had hitherto possessed it. The change was considered of such value as to be worth the payment of a thousand merks, and an annual sum of an hundred and thirty. But the king's promise of impartial protection to the Irish was grossly violated in the instance of Cathal Croove-derg, who was now deprived of the third part of his kingdom that had been allowed to remain with him by John, this portion being granted, together with all the rest of Connaught, to Richard de Burgho. Cathal died soon after this unjust deprivation of his property. His subjects, assisted by O'Neill, prince of Tyrowen, placed his brother Tirlogh on the throne; but he was removed by the lord-deputy, and Aedh, a son of Cathal, substituted in his place. Aedh being shortly afterwards killed in a skirmish, the lord-deputy again removed Tirlogh, whom the people of Connaught had reinstated, and placed Feidlim, another son of Cathal, upon the throne. But a title held under a tenure so precarious and degrading could not be satisfactory. Feidlim, therefore, crossed over to England, and threw himself on the protection of the king, by whom he received a special assurance of security in the possession of his territories, which enabled him to retain them unmolested till his death.

Towards the conclusion of his reign Henry made a grant of Ireland to his eldest son Edward; with a proviso, however, that it was to be always connected with and dependent upon the crown of England. The country derived no benefit from the arrangement. Edward was drawn away to pursue schemes of more brilliant promise in the Holy Land, and Ireland was suffered to continue under the management of subordinate officers. Its state was at this time truly miserable. In addition to the struggles of the Irish chieftains to regain their patrimonial rights of property and independence, the districts which acknowledged the English rule were torn to pieces by the hostilities of rival barons. To such a pitch did this state of anarchy increase, that in a contest between the De Burghos and the Fitzgeralds, the latter faction seized upon Richard de Rupella, the lord-justice of Ireland, and threw him, with several of his adherents, into prison, from which it required the authority of a parliament to liberate him.

The neglected state of the country during the reign of Edward I., whose attention was absorbed by the nearer and more pressing affairs of Scotland and Wales, increased the turbulence and audacity of the English barons. A dispute between Sir William de Vesci, the lord-justice, who had married an heiress of the Pembroke family, and John Fitzthomas, one of the heads of the Fitzgeralds, was carried to such a pitch, that each accused the other of high treason; and the affair was brought before the king in person, to be decided by the law of duel. On the day appointed for the combat, Vesci was not forthcoming. He had fled to France. The king transferred his lands in Ireland to his accuser, which contributed considerably to the future aggrandizement of the Fitzgerald family. So grievously was the great body of the Irish pressed down by the arrogant tyranny of these feudal lords, that they offered the king six thousand merks for a charter from him to be governed by the laws of England. This reasonable request, which implied nothing more than the enforcing of the previous charters of John and Henry to the same effect, was neutralized by the opposition of the barons, whose oppressions it was meant to curb. A second application of a similar nature during this reign met with a similar fate. The conduct of Edward to one of the lords-justices, De Ufford, whom he called over to explain why such quarrels were permitted during his administration, proves that the king was not over anxious to probe this malady to the bottom. De Ufford's defence of himself was, that "he deemed it expedient to suffer one knave to destroy another, to save expense to the king." Edward was satisfied with this evasive answer, and sent him back to his government. The wars of the barons were still tolerated; and the Irish, who wished for the protection of English law against their tyranny, were still forced to purchase it by special charters of denization, by the fees of which the officers of the court were enriched. These charters were mostly the consequence of intermarriages with some of the great English families.

The accession of Edward II. afforded a prospect of the restoration of the royal authority, and the suppression of the exorbitant power of the English barons. The king, compelled to part with his favourite Gaveston, sent him into Ireland as lord-lieutenant, as into a kind of honourable exile. On his arrival, Gaveston obtained some advantages over the Irish septs in the neighbourhood of Dublin; but, however flattering the appearances arising from this change of administration, they proved delusive. Edward, unable to endure longer his favourite's absence, recalled him, and the country fell back into the anarchical sway of the barons. The royal mandates were set at nought, and private wars carried on without restraint or control. Frightful as were the state and prospects of the country, a fresh ingredient of misery was now thrown in. Robert Bruce, king of Scotland, elated with the victory of Bannockburn, resolved on a measure which, if successful, would have added considerably to the security of his own kingdom, and to the weakening of his most formidable enemy. He proposed to detach Ireland from England, and to connect it with Scotland, either as an ally or a dependency. With this view, and also to give employment abroad to an ambitious and ardent relative, he proposed to his brother Edward the conquest of the country. The offer was accepted. The first attempt on the northern province failed, because the means were insufficient for the magnitude of the object. But Bruce was not to be discouraged by a single check. The attempt was soon afterwards renewed with enlarged resources. In the summer of 1315, Edward Bruce landed in the north of Ireland, at the head of six thousand men, where he was joined by numbers of the discontented Irish. De Burgho, earl of Ulster, aroused by the danger which threatened his possessions, aided by Feidlim, king of Connaught, marched to oppose the invader. Their combined force was defeated at Coleraine, and Bruce, following up his victory, reduced Carrickfergus; penetrated into Meath, where he defeated, at Kenlis or Kells, a second army sent to oppose him; advanced still further to Skerries, where he encountered and routed Sir Edmund Butler, the lord-justice; and returning to Dundalk, through want of provisions, was there crowned king of Ireland. His affairs were now singularly prosperous. His brother came to his assistance from Scotland, but was forced, through the scarcity of provisions, to return, leaving with him a part of his troops. Feidlim joined his party, and was followed by O'Brien of Thomond, and several lesser chieftains. The English barons now began to be sensible that the tenure of their possessions was at stake. They collected a numerous body of troops, which were sent, in the first instance, into Connaught, to put down Feidlim. A sanguinary battle ensued at Athenree, in which the Irish prince was slain, and with him terminated the last hope of the restoration of the monarchy of Ireland. Bruce, after refreshing his troops, marched to Dublin. To guard against his assaults, the citizens set fire to their suburbs, with such precipitation, that one of the churches was involved in the conflagration; and intrenching themselves within their walls, they presented such a face as deterred the besiegers from continuing the siege. Bruce therefore proceeded to Kildare, which he ravaged, and thence penetrated through the passes of Ossory into Munster, spreading havoc and desolation on all sides. Want of provisions, and the intelligence, on one hand, of another army having been collected against him, under the command of Roger Mortimer, sent from England as lord-justice, and on the other, of new supplies from home, led by his brother in person, induced him to retrace his steps towards Ulster. By forced marches he retreated unmolested into Meath. He was followed by the English, now under the command of Sir John Bermingham. Both armies met at Faugher, near Dundalk. The Scotch army was the more numerous, but it was much exhausted by fatigue and famine; the English were well equipped and armed, and in a high state of organization. It is said that Edward Bruce, on hearing that his brother was advancing, pressed on the engagement, in the hope of securing to himself the undivided honour of victory. The result was deserving of the arrogance which led to an act so ill advised and precipitate. After a sanguinary struggle, the Scottish army was totally defeated. The body of Bruce was found, after the engagement, in the midst of heaps of slain, lying under that of an English knight of the name of Maupas, who had pressed forward to the honour of being captor of the Scottish general. Robert Bruce, on hearing of the result, immediately returned home, and made no further attempt upon the country.

The expulsion of the Scotch gave little relief to the people, who still continued to groan under the feudal oppressions and interminable quarrels of their rulers. On the accession of Edward III. they addressed themselves again to the throne, in order to procure a general charter of admission to the rights of British subjects. The petition was favourably received; but being referred, like former applications of the same kind, to the Irish parliament, through the lord-justice, it was, like these, rejected. The Irish, disappointed in their hopes of good government, broke out into acts of insurrection. The king, unable to restore tranquillity by energetic measures, had recourse to others, the evil effects of which were long felt. The greater part of Leinster had been parcelled out into five palatinates, in favour of the five grand-daughters of Strongbow, on whom this princely inheritance had devolved in failure of male issue. Meath and Ulster had also been granted in like manner. The number of these exempt jurisdictions, in which the superior lord exercised most of the prerogatives of royalty, was now increased,

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by erecting the county of Desmond, or South Munster, into a palatinate in favour of Maurice Fitzthomas, a branch of the Fitzgerald family; and another was shortly after erected in Tipperary, for James Butler, created Earl of Ormond. In consequence of the great privileges bestowed on these noblemen, the king's authority was proportionally contracted, and a few powerful chieftains were enabled, under colour of asserting their rights, to overawe or control, by their combination, the wholesome exercise of the powers of the constitution, or to convulse the country to its centre, by their mutual contests for superiority. This ruinous system was carried still further. The chief governor, unable to collect men in numbers sufficient to cope with the insurgent Irish, applied for military aid to the Earl of Desmond. The request was readily acceded to, and ten thousand men were sent him; but as the deputy was deficient in the means of paying or feeding such a body, the troops were allowed to live on the country at free quarters, or, as it was then called, on coygne and livery, which consisted in the taking of man's meat, horse's meat, and money, of all the inhabitants, at the will and pleasure of the soldier, who had no other means of subsistence. This extortion was originally Irish, for they used to lay Bonaught, as they called it, upon the people, and never gave their soldiers any other pay. But under the English it was still more intolerable, as with them the oppression was not temporary or limited either in time or place, but, because there was everywhere a continual war, either offensive or defensive, and every lord of a country, and every marcher, made war and peace at his good pleasure, it became universal and perpetual, and was, indeed, the heaviest oppression that ever was inflicted on any kingdom, Christian or heathen.

The effects of this feeble policy proved the reverse of what its devisers may be supposed to have expected. Internal turbulence and discord increased. To heighten the confusion, William de Burgho, who united in his own person the government of the two palatinates of Meath and Ulster, and had also the greater part of Connaught, was assassinated at Carrickfergus by his own domestics. His only daughter was carried to England for protection. O'Neill of Tyrowen, to whose family the northern palatinate of De Burgho had formerly belonged, seized on the opportunity to recover by force a considerable portion of the inheritance of his forefathers. The estate in Connaught was also seized on by two of the younger branches of the De Burgho family, who, conscious of the illegality of their claim according to the rules of English law, renounced their allegiance, assumed the Irish name of M'William, distinguishing themselves from each other by the surnames of Eighter and Oughter, or the Hither and Further M'William; the former holding the lands in Galway, the latter those in Mayo, and both, conforming to the laws and tenures of the Irish, set the authority of the king's justice at defiance. But the act which tended most to destroy the English power, by unhinging the connection between the parent country and the colony that had sprung from it, was an order that all public officers whose property existed wholly in Ireland should be displaced, and their places supplied by persons born in England, and having lands in that country. This act gave rise to the distinction between the English by blood and the English by birth, causing those of the former class, through irritation at the insulting degradation by which they were deprived of their fair share of the honours and emoluments earned by the blood of their ancestors, not only to attach themselves to the native Irish by the ties of marriage and community of interests, but to exceed them in the intensity of hatred to the new intruders; and hence they were said to be more Irish than the Irish themselves. The effects of this unjust and impolitic ordinance were not long in showing themselves. A common interest united the descendants of the old settlers into a general combination. Alarmed at the spirit which they indicated, the lord-justice, Sir John Morris, deemed it expedient to assemble a parliament at Dublin, whereby a less dangerous vent might be afforded to the expression of the grievances of the discontented. But the injured party adopted another and a more spirited course. Not content with absenting themselves from parliament, they held another assembly, totally independent of it, at Kilkenny, under the auspices of the Earl of Desmond, in which they drew up a remonstrance, to be presented to the king, which exhibited a striking view of the aggressions of the government, and the grievances which had excited general discontent. The king's answer was gracious and condescending. Assurance was given them of immediate relief from the more gross grievances, and of inquiry into all. His anxiety to procure aid for his continental expeditions appears to have been one cause of the readiness with which these concessions were granted; for we are informed that the Earls of Desmond and Kildare attended him with numerous followers into France, and the latter distinguished himself greatly at the siege of Calais. But the spirit of self-interested monopoly which gave birth to this distinction, though repressed, was not extinguished; and fresh occasion was soon given it to blaze forth from a quarter whence it might least have been apprehended. Lionel, afterwards Duke of Clarence, Edward's second son, had married the heiress of the late Earl of Ulster, and thus became entitled to the lordships of Ulster and Connaught. To add weight to the enforcement of his claim, which he was about to assert in person, the king invested him with the lord-lieutenancy of Ireland. But, born and educated in England, he carried over with him all his English prejudices and prepossessions. Surrounded by men of English birth, and taught by them to look on the ancient settlers, not only as unworthy of his confidence, but as disaffected to his government, he forbade, by proclamation, any of the old English, or of the king's subjects of Irish birth, to approach his camp. This imprudent measure deprived him of the only aid which could render his operations against the common enemy of the English government effectual. Left, amongst strangers to the country, to traverse unknown districts, and to contend against an enemy of whose movements and mode of action he was wholly ignorant, he found himself enclosed in a position in which advance was impossible and retreat perilous, and from which he was extricated solely by an appeal to those whose services he had at his first landing so haughtily and unwisely rejected. After a short stay he was recalled, but returned in a few years, improved in the knowledge of the science of governing a country of habits dissimilar to those of his own. On his second visit he directed his attention to the general reformation of the parts of the island that yielded a willing obedience to the royal authority. A parliament was summoned at Kilkenny, the result of whose deliberations was an ordinance, since known by the name of the Statute of Kilkenny, which forms one of the great political epochs in the history of the country.

By this statute it was enacted, that marriage, fostering, or gossipred with the Irish, should be deemed treasonable; and conformity to the rules of Irish law was subjected to a similar penalty. The use of Irish names, language, or apparel, by any person of English birth or descent, was punishable by forfeiture of lands or imprisonment. Penalties were also imposed on those who permitted their Irish neighbours to graze on their lands, who presented them to ecclesiastical benefices, who admitted them into religious houses as members, or who gave encouragement to the Irish bards, musicians, or story-tellers. The execution of this statute was enforced by the anathemas of the church against its violators. Whatever might have been the effects of an enactment so rigorous towards uniting the English settlers more closely among themselves, it is evident that it severed completely any links of the bond of mutual charity and community of interests that existed between them and the Irish. The presence of an English nobleman of royal birth, connected by marriage with the descendant and representative of a family now nearly Irish through length of residence, might have led to the introduction of a system of generous equity towards the natives of the country, the former rightful possessors of the soil. But the wording of this statute pronounced the Irish to be irreclaimable. The opportunity for the amalgamation of conflicting interests was lost; and ages passed over without another such presenting itself for a renewal of the experiment. The Duke of Clarence was again recalled, and the administration of the government left, as before, to deputies. The low condition to which the country was now reduced may be inferred from the fact related as to Sir Richard Pembridge, warden of the Cinque Ports, who, on being appointed to the lieutenancy, refused to undertake the office, in consequence of the distracted state of the country; and it was adjudged that his refusal was strictly legal, inasmuch as residence in Ireland, even in the elevated station assigned to him, was looked upon as but an honourable exile, to which no freeman was to be subjected, except in case of abjuration for felony, or by act of parliament. So far was the English power reduced towards the close of this reign, that, as the authority of the English law had extended during the time of John over the twelve counties already named, and over the greater part of Connaught, it was confined, in the thirtieth year of the present reign, to the four counties of Meath, Louth, Dublin, and Carlow; and of these the greater part was border-land, governed by march law, which was little more than another word for the arbitrary will of the lord of the marches. The last effort made by Edward to restore the English government, was a mandate directing a stated number of bishops, knights, and burgesses to attend the king in his parliament in England, to assist in enacting laws for Ireland. The proceedings of this parliament are lost, but the existence of writs to the several counties, cities, and boroughs, directing them to defray the expenses of the persons sent over, proves that it had assembled. About the same time the trade with Portugal was thrown open to the Irish, but the disorders of the country were too deeply rooted to admit of the people availing themselves of the privilege.

In the beginning of the reign of Richard II., Robert de Vere, earl of Oxford, was appointed lord-lieutenant of Ireland by the joint consent of the king and the English nobility; the latter party wishing thus to break the connection of favouritism that bound him to the former. But after an equipment, fitted out on a princely scale, the project failed. He had proceeded as far as Wales, when Richard, who accompanied him to the water's edge, found his attachment too violent to bear the separation, and brought him back to London. Commissioners were afterwards deputed to inquire into the state of the country, but with no beneficial result. At length Richard resolved to visit this part of his dominions in person. He landed at Waterford with an army of four thousand men-at-arms and thirty thousand archers; but after nine months spent in an empty display of regal pageantry, during which he received the submission of seventy-five native Irish or degenerate English chieftains, and granted pardons to others, whom an apprehension of ill treatment kept at a distance, he returned to England. The only stipulation for restoring tranquillity made during his visit was, that the province of Leinster should be evacuated by the Irish; but when the condition was to be enforced, after the removal of the terrors of a royal army, the requisitions of the government were followed only by excuses and delays, and ultimately by insurrection, in the course of which Roger Mortimer, earl of Marche, whom Richard had left behind him as his lieutenant, was killed at Kenlis, in a skirmish against the O'Byrnes, whom he had driven from their mountain fastnesses in Wicklow.

Mortified and irritated by a result so contrary to the anticipations entertained from his expensive armament and pompous reception in Ireland, Richard undertook a second military expedition thither. He landed again in Waterford, and after spending some time there and at Kilkenny, in an idle display of royalty, he proceeded to Dublin, in the full confidence that now, as previously, his journey thither would be but a progress of pacific parade. In this expectation he was buoyed up by the appearance of several of the Irish lords, who, presenting themselves with halters round their necks, fell at his feet and implored forgiveness with the most abject humility. But on entering into the woods and defiles of the marches of Leinster, his reception was very different. M'Murchad, the principal chieftain of the province, who, notwithstanding the pensions he had received, and the submissions he had entered into, was still the inveterate enemy of the English, rushed out unexpectedly from the cover of his woods, at the head of three thousand chosen men, so well appointed, and with such a display of valour, as to stop the advance of the royal army for some time; and though it ultimately forced its way to the capital, such were the losses sustained by famine, hardship, and battle, that Richard had to wait for a reinforcement from England before he could resume hostilities. In the mean time the news of the successes of the Duke of Lancaster compelled him to hasten his departure, in order to oppose this new enemy. The unfortunate and disgraceful termination of his reign belongs to English history.

The intestine commotions in Ireland were aggravated in the reign of Henry IV. by invasions of the Scotch, who assisted the Irish of Ulster in driving the English from this province, and acquired some settlements there, whence they were never afterwards wholly removed. Henry's second son, Thomas, duke of Lancaster, was sent over as lord-lieutenant. His government was vigorous, and in some degree effective. The native Irish of Wicklow were checked; the degenerate English in Meath and Uriel were compelled to submit; and M'Murchad, who still maintained himself in the western parts of Leinster, in defiance of the government, was defeated in a severe and well-contested battle. The citizens of Dublin fitted out several naval expeditions against the Scotch and Welsh; and though, in their first engagement with the former enemy, they suffered a total defeat on the coast of Ulster, they afterwards revenged the insult by carrying the war into the islands and coasts of Scotland, and by their depredations in Wales, whence they brought back in triumph a shrine of St Cubin, and lodged it with much ceremony in Christ Church, as a proud monument of their victory. But this favourable change was merely temporary. The lord-lieutenant was wounded, and his forces beaten back, under the very walls of Dublin; and he soon afterwards quitted the country altogether. The residents in the border counties were now reduced to the degrading necessity of purchasing peace and protection from the neighbouring Irish chieftains, by the payment of a stipulated tribute called black rent.

The arrival of Sir John Talbot, Lord Furnival, in the succeeding reign, a man distinguished for his military talents, gave hope of a change for the better. By his activity and valour he compelled several of the neighbouring Irish chieftains, not only to desist from their incursions, but also to do homage and give hostages. Yet though bound to keep the peace, they still retained their independence,

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and the English pale was not enlarged. The lord-lieutenant, likewise, having brought with him no supplies either of men or money, had no means of maintaining his position, except the oppressive and ruinous system of coygne and livery. The English settlers were thus reduced to a state of extreme degradation and distress. Looked upon by the Irish as aliens and intruders, they were treated by the new comers from England as slaves, and considered by the English in general as in nowise better than the natives. In the beginning of this reign, the parliament at London, in consequence of the swarms of needy adventurers from Ireland, whom the devastations of their own country had driven to seek an asylum abroad, passed an act to oblige all Irish to quit the kingdom. Even the students who resorted to London for education, though expressly excepted from the severe provisions of the statute, were contemptuously excluded from the Inns of Court, from a prejudice as impolitic as it was unjust, since it not only precluded them from an intercourse tending to conciliate their affections to England, but debarred them from the means of acquiring a knowledge of the laws, which were the only effective means of preserving the connection between the countries. Indeed the continuance of such connection was preserved at the present period, more by the ignorant prejudices of the native princes themselves, than by the exertions of the government. Contented to rule over their petty septs, their aversion to the English was scarcely more violent than that entertained by them against the neighbouring tribes of their own race. They united in the most cordial attachment with the old English in their revolts; and their insurrections, far from being excited by a general desire of exterminating the whole body of their invaders, were usually occasioned by some local dispute or act of private oppression.

In the beginning of the reign of Henry VI. the two Anglo-Irish families of Desmond and Butler began to assume the high political position which they retained long after. James, the first Earl of Desmond, obtained the leadership of the family and the title, to the prejudice of his nephew, who had degraded himself in the eyes of his followers by marrying a peasant's daughter. The uncle was secured in the estate by authority of parliament, and also constituted governor of the counties of Waterford, Cork, Limerick, and Kerry, over which he exerted an almost royal jurisdiction. The Earl of Ormond, the head of the Butler family, after having been removed from the chief government of Ireland by the machinations of his enemies, was protected against their further efforts by the personal kindness of Henry VI., which laid the foundation of a lasting attachment to this monarch on the part of the earl and his descendants. A change now took place in the government, more important in its effects than any hitherto recorded. Richard duke of York, descended from an elder brother of the prince through whom the reigning family derived its claim to the throne, was universally beloved. The contrast between him and his inglorious sovereign was too glaring to remain unnoticed. It was therefore resolved to remove him out of England; and he was appointed lord-lieutenant of Ireland, with extraordinary powers. His administration presents one of the few bright gleams of Irish history. It was long quoted as the time when peace and prosperity flourished, when faction was repressed by even-handed justice, and when the natives, the English by blood, and the English by birth, coalesced in an honest exertion to improve the country. Aware, on his arrival, of the bitter jealousy which existed between the rival families of the Butlers and Geraldines, and although he knew that the former was attached by gratitude to his rival, he scorned to be swayed by any suspicions on that account; but, on the birth of his son, afterwards the unfortunate Duke of Clarence, by engaging the heads of both families to be sponsors at the infant's baptism, he bound each to himself and to the other by the tie of gossipred, a relationship respected to a degree of veneration amongst the Irish. Being called away to England to clear himself from some imputations on his loyalty, he intrusted the administration to the Earl of Ormond, who was succeeded by Sir Edward Fitz-Eustace, a knight of great military fame, by whom the O'Connors of Offaly were defeated, and the sept of the O'Neills, who had presumed to insult the city of Dublin by plundering some of the ships in the bay, and carrying off the archbishop, were so roughly treated at Ardglass, as to check for a long period any efforts of the northern toparch against the pale. In the mean time the Duke of York, though successful in his first effort to seize the English crown, was totally defeated at Bloreheath, and forced to fly into Ireland, where he was received more like a sovereign prince than a discomfited traitor. The parliament passed an act for his protection, and decreed that whosoever should attempt to disturb him, under pretence of writs from England, should be deemed guilty of high treason. An agent of Ormond, who ventured to violate the law, was executed. On the duke's subsequent change of fortune, numbers of his Irish adherents followed him to England. The palatinate of Meath, in particular, was almost deserted by the English settlers, who hastened to enrol themselves under the banner of the white rose. He appeared in London with this gallant train; but the war being unexpectedly renewed, he was encountered at Wakefield by an army four times more numerous than his own, which consisted but of five thousand men, mostly Irish, and fell in the unequal contest, together with the greater part of his devoted followers. The exhaustion thus produced was nearly fatal to the English interests in Ireland. Towards the close of Henry's reign, the Irish or rebellious English had conquered or subjected to tribute the greater part of the counties of Limerick and Tipperary, together with those of Kilkenny and Wexford, and almost the whole of Carlow, Kildare, Meath, and Uriel, so that little was left, of which the English could claim the undisputed possession, excepting the county of Dublin. The only method to secure peace was by the purchase of the protection of the heads of the Irish septs, who, gratified with such acknowledgment of their superiority, looked with contemptuous disregard on the movements of the Saxons, as the English were called by them.

The attachment of the Geraldines to the house of York was rewarded by Edward IV. on his attainment of the royal dignity, by appointing the Earl of Kildare to the lord-lieutenancy. He was shortly afterwards superseded by the Duke of Clarence, the king's brother, who appointed the Earl of Desmond his deputy, in return for having crushed an effort made by the Butlers in favour of the house of Lancaster. But his continuance in power was short-lived. On the king's marriage with Elizabeth Grey, he had incautiously thrown out some reflections upon the meanness of her birth. Tiptoft, earl of Worcester, was soon afterwards sent over as lord-deputy, and, in a parliament summoned at Drogheda, he caused an act to be passed against the Earls of Kildare and Desmond, for allying themselves by marriage, and fostering with the Irish enemy. Kildare, though arrested, was fortunate enough to effect his escape. Desmond, relying either on his innocence or his influence, came forward to justify his conduct, and was immediately seized and executed without even the formality of a trial. This monstrous outrage did not long go unpunished. Kildare justified himself so effectually before the king, that he was not only restored to his titles and estate, but appointed chief governor; and Tiptoft, being recalled into England, suffered, in a new revolution, the same fate which he had inflicted upon Desmond. The defence

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of the confined limits of the pale was now intrusted to a military order established by authority of parliament, under the name of the Fraternity of St George. It consisted of thirteen leaders of the first consequence in the four counties of Dublin, Meath, Kildare, and Uriel, who had under them forty knights, as many squires, and an hundred and twenty mounted archers. The appointment of a force so inadequate to preserve the peace even of the contracted limits it was intended to protect, evinces in the strongest manner the reduced state of the English power after the termination of the desolating conflict between the rival roses.

The short and distracted reign of Richard III. allowed no time to attend to the state of Ireland. His successor, for what reason it is not known, suffered the government to continue in the hands of the Fitzgeralds, the avowed friends of the house of York. The evil consequences of this policy, or negligence, were not long in showing themselves. Lambert Simnel, who had been set up by the king's enemies on the Continent to personate the Earl of Warwick, son of the late Duke of Clarence, was sent by them to Ireland, as the place most favourable for the design. He was received by the Earl of Kildare, then lord-lieutenant, as the lawful sovereign; proclaimed king; publicly crowned in Christ Church, with a crown taken for the purpose from a statue of the Virgin Mary; and borne thence to Dublin Castle on the shoulders of Darcy of Platten, according to a form used in the inauguration of the native Irish kings. A parliament convened by his writ, under the title of Edward VI. granted subsidies, and enacted severe laws against those who refused to recognise his right, amongst whom the chief were the families of Butler and Bermingham, and the citizens of Waterford. Fortunately for the peace of the country, the arrival of a body of German auxiliaries from Flanders, under the command of Martin Swart, inspired the partisans of Simnel with such an overweening confidence in their own strength, that they determined to transfer the seat of war to England. Thither Simnel went, attended by the flower of the Irish nobility, and a numerous following of the natives. He was met at Stoke, in Nottingham, and defeated by Henry with immense loss, as the Irish, whose light arms could make no impression on the compact and iron-bound ranks of their adversaries, refused quarter, defending themselves singly, even when routed, until they fell overwhelmed by numbers. Simnel, when taken prisoner, was punished, not by severity, but degradation. He ended his life as a scullion in the royal household. The actors in this hasty and ill-digested movement were not treated harshly. Even the city of Dublin was pardoned, on its humble submission. But, in the hope of securing the future allegiance of the great residents, Sir Richard Edgecombe was sent over as a special commissioner, with a train of five hundred men, to receive their submission, and administer the oath of allegiance. On his arrival at Kinsale, his apprehensions at first prevented him from landing; and he received the homage and oaths of Lord Thomas Barry, a principal nobleman of the district, on board his ship; but afterwards landed, and was received in Cork, Waterford, and Dublin, in a manner befitting his mission. The Earl of Kildare hesitated for a time, but at length joined with the others in tendering this proof of submission to the ruling power.

Another claimant of the throne now appeared in the person of Perkin Warbeck, who was, or pretended to be, the Duke of York, second son of Edward IV. He landed at Cork, where his identity was acknowledged. On his arrival there he wrote to the Earls of Desmond and Kildare. The former recognised him at once; but before the latter could decide on the part he ought to take, the adventurer had removed to the French court, whither he had been invited for the purpose of more effectually annoying the English king. Henry now sent over into Ireland Sir Edward Poynings, a knight of distinguished ability, accompanied by several English lawyers to fill the offices of judges; those then on the bench, who owed their elevation to party influence, being notorious for their incapacity.

The administration of this governor forms a new era in the history of the country. A parliament assembled by him enacted several useful laws, two of which were peculiarly influential in breaking down the exorbitant power of the nobility. By one of these, all the statutes hitherto passed in England were made law in Ireland; by the other, it was enacted that no parliament should be held until the reasons for holding it, and the statutes to be proposed in it, should be approved by the privy council of England. Warbeck made a second attempt upon Ireland, in which he was openly assisted by the Earl of Desmond; but after an unsuccessful attempt on Waterford, he was forced to quit the country, and take refuge with the king of Scotland. The enemies of Kildare were not remiss in seizing this opportunity to crush him; and the Butlers importuned the lord-deputy to imitate the example of Tiptoft, and consign him at once to the executioner. But Poynings rejected the cruel and impolitic suggestion, contenting himself with sending the earl to England to answer in person the allegations brought against him. This proceeding, as just as it was merciful, led to a conclusion wholly opposite to the anticipations of his enemies. When warned by the king to choose able counsel to defend himself against the heavy charges advanced against him: "Yes," said Kildare, "I choose the ablest in the realm; I take your highness as my counsel against these false knaves." Charge after charge was alleged against him, and answered; amongst others, that of having burned the church of Cashel. On hearing this brought forward, Kildare interrupted the speaker: "Spare your evidence," said he; "I did burn the church, but I thought the bishop had been in it." This extraordinary plea raised a laugh amongst all present. His accusers in a rage exclaimed, "All Ireland cannot rule this earl." "Is it so?" replied Henry; "then this earl shall rule all Ireland;" and he sent him back as lord-deputy. The event justified Henry's sagacity. Kildare repaid his sovereign's confidence by a government of unremitting zeal, energy, and fidelity. The boundaries of the pale were gradually extended; several septs, to whom tribute had hitherto been paid, were forced to submit. He marched a gallant army into Connaught, against Ulick de Burgho, the head of the degenerate English in that province; more, it must be acknowledged, to gratify private resentment than to promote the interests of his royal master. The armies met at Knocktow, near Galway. The victory of the deputy was sullied by the ferocity of his troops, who refused to give quarter, and continued the massacre until night forced them to desist. This victory reduced the whole of Connaught to obedience. The O'Neills and the O'Briens were the only septs of any consequence who still refused to tender their allegiance.

The Earl of Kildare was continued in the government by Henry VIII., who testified his approbation of his services by appointing his son Gerald his successor. The young earl, with the characteristic valour of the family, inherited a more than ordinary share of their pride and imprudence. Too haughty to court the favour of Wolsey, then in the zenith of his greatness, by meanness and subserviency, he incurred that proud prelate's hatred, which was heightened by the artful suggestions of his rival the Earl of Ormond. Through the machinations of this nobleman he was removed, and summoned to England to account for his conduct. Here, strengthened by a marriage with the daughter of the Marquis of Dorset, he was enabled to baffle the efforts of the cabal formed against him.

He attended Henry at his celebrated interview with Francis I., and, by the splendour of his suite, and the brilliancy of his equipage, contributed largely to the splendour of "the Field of the Cloth of Gold." On his return home, the struggle between the rival families attained to such a height, that commissioners were sent from England to investigate the case. Their report, when laid before Henry, induced him to remove from the head of affairs Pierce earl of Ormond, better known in the chronicles of the times by the name of Red Peter, the deputy to the Earl of Surrey, then lord-lieutenant, and to substitute his rival in his place. The decision proved eventually fatal to this nobleman. Inflated with an opinion of his own greatness, he acted so as to excite a suspicion of aiming at the assumption of independent power in Ireland. His enemies pressed the charge against him, and a peremptory order was issued for his immediate attendance at court. Unwilling to quit the seat of power, conscious most probably that his conduct would not bear a strict investigation, he endeavoured, through his wife's relations, to evade obedience; but finding all his efforts ineffectual, he ultimately repaired to London, after having supplied all his castles with arms and ammunition from the royal stores, a measure tending most powerfully to confirm the prejudice raised against him. On his arrival there he was forthwith thrown into the Tower.

That the royal anger against the earl had not been very violent, is evident, notwithstanding the harsh treatment thus inflicted on him, from the fact that he was permitted to commit the government during his absence to some person for whose conduct he should be responsible. By a step still more unaccountable than any of those that had involved him in suspicion, he intrusted the administration to his eldest son Thomas, a stripling scarcely twenty-two years of age, who, to the rashness of youth, and a natural violence of temper, added an insolent contempt of his rivals, and a boyish confidence in the irresistible power of the Geraldines. The news of his father's imprisonment could not fail soon to arrive in Ireland. Common fame, aided by the artifices of the enemies of the family, swelled it into an assertion of his execution. The young lord lent a credulous ear to these falsehoods, and, as impetuous as he was credulous, instantly had recourse to means of vengeance as desperate as they were chivalrous. Attended by a retinue of an hundred and forty followers equipped in a style of gaudy display, which, even in those times of courtly splendour, earned for him the title of "the Silken Knight," he proceeded to St Mary's Abbey, on the northern bank of the Liffey, where the privy council were assembled; and there, throwing down the sword of state, he solemnly renounced his allegiance, and declared himself the mortal enemy of the English government. All the other members of the council gazed on him in silent astonishment. Archbishop Cromer, then primate and chancellor, alone interfered, and remonstrated with the fiery young man on the madness of the act he was committing. The appeal to his better judgment was interrupted by the family bard, who, unconscious, through his ignorance of the language, of what was going forward, commenced a rhapsody on the glories of the Geraldines, the treatment of their chief, and the vengeance which it claimed. Passion prevailed over prudence. The voice of age and wisdom was drowned in the clamours of his attendants, and the young lord tore himself from the chancellor, rushed out of the council board, and, without premeditation or preparation, plunged into a war against the whole power of England.

Baffled in an attempt to surprise the castle of Dublin, Lord Thomas ravaged all the district of Fingal, in its northern neighbourhood, during which Alen, archbishop of Dublin, one of the determined enemies of his family, was taken prisoner. When brought before him, his hasty expression, "Away with the English churl," was translated by his rude Irish followers into a mandate for execution, and the wretched man was immediately butchered. He then renewed his attempt to seize the castle, but was prevented, and eventually driven from the city by the citizens, who even burned part of the suburbs, to prevent them from affording shelter to his troops. From being the aggressor, he was now forced to act on the defensive. Maynooth Castle, his strongest fortress, was invested, and, after a resistance of fourteen days, was captured by the treachery of a foster brother of Lord Thomas, who, after having been paid the pecuniary remuneration of his treason, received a more adequate recompense by being hanged by the orders of the English deputy. The irregular army of the insurgents began to dissolve on the intelligence of this disaster, and their leader was driven to a desultory warfare in the fens and mountains, from which he was inveigled by a solemn assurance of pardon given by the English general Lord Grey, and confirmed by the communion of the holy sacrament. Grey was rewarded for his services by the office of lord-justice. His first act of government was one of atrocious perfidy. In spite of his previous solemn promise, he sent his prisoner to London, where the first news the wretched youth received was, that his father had died, not by legal execution, but through grief at his insane rebellion. This act of Grey was followed by a similar one, if possible of deeper guilt. Henry breathed the most furious revenge against the whole family of Kildare, and sent orders to have the five uncles of the young lord seized. To effect this, the lord-deputy invited them to a banquet, where, in the midst of the pretended hospitality, they were arrested, forced on board ship, hurried to England, and executed along with the real instigator of the rebellion. A brother of Lord Thomas, a boy about twelve years of age, who was also included in this decree of blood, after having been sheltered for some time, at no small risk, by his aunt, the widow of M'Arthy, a Munster chieftain, was conveyed to France, and, when Henry had the meanness to claim him as a subject, he escaped to Flanders. Thence, when pursued by the same spirit of despicable malignity, he fled to Germany, and finally found shelter in Rome, under the protection of Cardinal Pole, who, in defiance of Henry's protestations, received and educated him as his kinsman, and, by his favour and support, enabled him to recover his birthright, and restore the otherwise extinct honours of the house of Kildare.

A period now arrived in which religion, hitherto little noticed in the political events of the country, was forced to assume a character as dissonant to its real nature as prejudicial to its true interests. Henry determined to extend to Ireland the reformation he had with so little opposition established in England. Commissioners were sent over to procure an acknowledgment of the king's supremacy, who, though opposed by Cromer, the archbishop of Armagh, a strenuous champion for the religion at that time established by law, succeeded in obtaining it. A parliament, assembled at the special suggestion of Browne, the first Protestant archbishop of Dublin, exhibited a subserviency to the royal wishes as great as even the despotic character of Henry could require. It pronounced the king's marriage with Catherine of Aragon null; declared the inheritance of the crown to be in the king's heirs by Anne Boleyn; and as the passing of this declaration was followed by an account of that unhappy lady's condemnation and death, and the king's subsequent marriage with Anne Seymour, it altered the succession anew to correspond with the new change in the king's disposition. It also acknowledged the king's supremacy in the fullest manner, forbade appeals to Rome, renounced the authority of the Romish see, and decreed the suppression of most of the monastic institutions.

An act, more creditable to the body whence it emanated, was also passed, by which schools were to be founded in every parish for instructing the natives in the English language, and in the rudiments of useful knowledge.

But words and writings were not of themselves sufficient to accomplish the mighty undertaking which Henry's impetuous zeal had commenced. The Irish clergy in general were averse to a change. Many of them relinquished valuable preferments rather than submit to it. The Irish chieftains found in it a new motive to animate themselves and to influence their followers against the Saxons. The feeling was fomented by a communication from Rome, exciting the northern chieftains, and more particularly O'Neill, to rally round the sacred standard of their forefathers. O'Neill joyfully accepted the post thus assigned him. He proclaimed himself head of the northern Irish, assembled a numerous force, advanced to Tarah, and there had himself proclaimed on the ancient hill of royalty of the native monarchs of Ireland; but, content with this idle display of pomp, he prepared, after ravaging the country, to return into his own demesnes. The deputy had expected this storm, and was prepared against it. With the forces raised in Dublin and Drogheda he pursued the retiring Irish, and overtook them at Bellahoe, on the borders of Meath, where, after a partial engagement, in which the van of the latter army only was concerned, the Irish fell back on their main body, which, struck with an unaccountable panic, immediately gave way and fled. The administration of Lord Grey ended with this victory. He was recalled, and thrown into the Tower, on charges equally futile and malicious. Apprehensive of the irritable temper of his brutal master, he waived all defence, pleaded guilty, and perished by the same fate into which he had so treacherously drawn Lord Thomas Fitzgerald and the rest of the ill-fated Geraldines.

The next step taken by Henry to complete the tranquillization of Ireland, was the assumption of the royal title. Hitherto, though exercising all the essentials of sovereignty, the kings of England had contented themselves with the title of lords of Ireland. This term was now changed by act of parliament into that of king. The alteration was commemorated by conferring peerages on several of the heads of the great families. O'Neill was made Earl of Tyrone, with the singular privilege of transmitting the title and estate to an illegitimate son, to the prejudice of his lawful issue. Ulick de Burgho was created Earl of Clanricarde, and O'Brien Earl of Thomond. Several of inferior note were created barons. Besides the act declaring the king's regal title, others, to the following purport, give striking indications of the manners of the times: Laymen and boys were excluded from ecclesiastical benefices; homicide and robbery were punished by fine, wilful murder and rape by death; coygne and livery were prohibited, unless by command of the lord-deputy; idle men and retainers were forbidden; noblemen were allowed no more than twenty cubits or bandles of linen in their shirts, which were not to be dyed with saffron; and the people of a country into which a theft was traced, were to trace it thence, or make restitution. A glaring omission in these statutes rendered them almost nugatory. Whilst the great lords were rendered more dependent on the crown by the abolition of their ancient tenures, no provision was made in favour of the subordinate chieftains, or the great mass of the population, over whom their ancient masters were still permitted to exert their former arbitrary dominion. Neither was this omission caused by inadvertence. The petitions of the natives to be governed by English law were disregarded or denied. O'Byrne, the head of a sept which had long kept the capital in a state of alarm, vainly petitioned that his territory should be converted into an English county by the name of Wicklow. A similar proposal for the Annaly, from its proprietors the O'Ferrals, was treated in like manner, although the king, when applied to, had acquiesced in the arrangement. The only territorial change ventured upon by the lord-deputy was the division of the territory of Meath into the counties of East and West Meath. Still, however, the civil reformation of the country was in progress. A state of general tranquillity was perceptible. Such, indeed, was the spirit of allegiance at this period, that Francis I. then at war with England, found it impossible to move the Irish to insurrection. On the contrary, Henry was attended to Calais on his French expedition by a considerable body of Irish troops, who distinguished themselves equally by their agility during the march, and their ferocity in the combat.

But the happy prospect which now began to dawn over the country was marred by the mismanagement of the English government. O'More and O'Connor of Offaly had renewed their incursions into Leinster. They were soon driven back into their fastnesses, whence they were lured, by a delusive expectation of pardon and favour, on condition of presenting themselves to the king. Scarcely, however, had they arrived at court when they were seized and thrown into prison, where the former soon sunk under the severity of his treatment. The disgust excited by this act of treachery was heightened by the manner in which the reformation was pressed upon the people. When Dowdal, the primate, who had succeeded Cromer, refused to countenance the new doctrines, an old controversy relative to the superiority of the sees of Armagh and Dublin was revived, and, by a royal patent, the title of primacy was transferred from the former to the latter see. Dowdal, unable to brook the indignity, peevishly as well as injudiciously deserted his see, and retired to the Continent. The opposite party, taking advantage of this false step, immediately placed Goodacre, a Protestant bishop, in the see he had abdicated. Throughout the country parts also, the removal of the clergy of the ancient faith, and the introduction of those of the new doctrines, were carried on in a spirit of violence and acrimony unbecoming the cause and irritating to the people. The garrison of Athlone attacked the ancient and venerated recess of Clonmacnois, plundered its furniture, defaced its ornaments, and defiled its altars. Similar excesses took place in other parts. Thus the impression made by those champions of reform was, that the new system sanctioned sacrilege and robbery. In the north, the general peace was disturbed by the family dissensions of the O'Neills. Shane or John O'Neill, the legitimate son of the first Earl of Tyrone, laboured sedulously to induce his father to alter the arrangement which gave the inheritance to his natural son Matthew. The latter threw himself for protection on the lord-deputy, who could devise no better means for closing the family schism, than by seizing on the persons of the earl and his countess, whom he kept in close confinement. The consequence of this arbitrary act was the throwing the whole of that country into the hands of Shane, who claimed it by the principles of the English law, and who, assisted by a body of Scots, committed terrible depredations on the property of those who disputed his right or set his power at defiance.

A new revolution, occasioned by the death of Edward VI. added to this state of confusion. The religion was again changed. Dowdal was recalled to the primacy; the most violent of his opponents fled the country, and the great body of the clergy returned to their former faith. This restoration was attended with no acts of violence; the Protestants were not persecuted. On the contrary, several of the English, who had fled from the severity of the law in their own country, were received and sheltered by the Catholics in Ireland. Not so with the Irish. The septs of Leix and Offaly resisted the forfeiture of their lands. They insisted that the offences of their leaders ought not to involve in their confiscation the inferior heads. They took up arms in defence of their rights; but they were soon taught the futility of their opposition. An armed force was sent into the country, which proceeded in the work of extermination with such ruthless ferocity, that scarcely a remnant of the ancient residents could be found to avail themselves of the tardy pardons procured for them by the generous interference of the Earls of Kildare and Ossory. The territory was reduced into shire-ground, under the names of the King's and Queen's Counties, in honour of Philip and Mary, whose names were given to the respective assize towns of each.

Elizabeth, on her accession, found the whole island involved in a state of petty warfare. The Earl of Thomond contended with another branch of the O'Briens for the rulership of North Munster. The Desmonds and Butlers renewed their contentions in the south. M'William Oughter rose in arms against the De Burghos of Clanricarde. The dispossessed inhabitants of Leix and Offaly revenged themselves by the pillage of the neighbouring districts of Leinster, and Shane O'Neill was making rapid strides towards the sovereignty of the whole of Ulster. The last named of these parties was the first pacified. Sir Henry Sidney, the new lord-deputy, instead of turning the military force of the queen against him in the first instance, had recourse to gentler measures. Accepting an invitation to settle the matters in controversy at O'Neill's own residence, he was received with such splendid hospitality, and heard such a statement of facts, as induced him not only to relinquish all ideas of severity, but to engage to be his mediator with the queen. O'Neill even attended the lord-deputy to Dublin; but when there, being made more fully aware of the deadly machinations of his secret enemies, who thirsted to make his princely property an object of confiscation, he adopted the daring resolution of proceeding to London, and laying his case before the queen in person. Attended by a chosen band of followers equipped in the most appropriate costume of the country, he entered that city, to the astonishment and delight of the population, then as well as now fascinated by show and singularity. A native Irish chieftain, followed by a band of men armed in a strange fashion, with heads bare, their hair flowing in clustering curls on their shoulders, clad in saffron linen vests of exuberant folds, surcharged with light and polished cuirasses, and bearing broad double-edged battle-axes over the shoulders, caught the fancy and dazzled the imagination, not only of the populace, but of the queen herself. She received the singular visitant with marked favour, and sent him back to Ireland secured in the possession of the title and property which he claimed as his right upon his father's death. But this unexpected tide of royal favour only whetted the ingenuity of his enemies at home. Complaint after complaint, either of actual offence or of imputed ill intention, was sent over to Elizabeth, whose answer, "that if he revolted it would be better for her servants, as there would be more forfeitures to divide amongst them," excited their hopes, as the prospect of the prey had roused their cupidity. Sir Henry Sidney had placed a garrison in the town of Derry. This step O'Neill considered as an infringement of his rights, and an intrusion on his sovereignty. A body of forces led by him against it defeated and slew the governor. Shortly afterwards, the church, which had been used as a powder magazine, was blown up by accident, and the garrison forced to evacuate the place. This event was construed by the people into a judgment from heaven for the profanation. O'Neill then proceeded to Armagh, which he took by storm, and burned the cathedral; but was baffled in a subsequent attempt upon Dundalk. The tide of fortune now set strongly against him. Several of the native chieftains in the north, and Desmond in the south, took part with the government. His forces were unequal to contend against such a combination. Finding resistance hopeless, his first emotion was to throw himself on the mercy of the lord-deputy; but the treatment of O'More under similar circumstances deterred him. He therefore determined to seek the protection of a body of Scotchmen, who were encamped in that part of Antrim then known by the name of Claneboy. His proposal of joining this party, which was readily accepted by them, became known to the English governor, who sent an officer of the name of Piers to the Scotch commander, to persuade him to assassinate his unsuspecting guest. The plot succeeded. O'Neill, on his arrival, was assailed by a party of his host's followers, upon the futile pretence of a sudden quarrel during the entertainment to which he was invited. His head was sent to Dublin, and Piers received a thousand pounds for his share in the transaction. The deputy named a feeble old man, named Tirlogh Leynagh, as head of the sept, to prevent this office being filled by a more youthful and daring individual.

The ruin of O'Neill in the north was followed by that of Desmond in the south. A small body of Spaniards was brought into that part of Ireland by a banished branch of the Fitzgerald family. Though the Earl of Desmond steadily persevered in avoiding to connect himself with their proceedings, the conduct of some of his relations involved him in suspicions, which were then nearly tantamount to guilt. His brothers Sir John and Sir James having joined the invading party, the former disgraced himself, and injured his cause, by the unprovoked murder of an English gentleman of the name of Davels, who had been sent by the deputy to persuade them to continue in their allegiance. The whole force of the government was directed against the family. The army of the insurgents was utterly routed at Kilmallock. The earl himself, though as yet guilty of no overt act, received a peremptory order to surrender within twenty days; and upon his declining to appear, he was declared a traitor. The war was carried on against him with unexampled cruelty. Slaughter, fire, and famine, desolated the finest parts of the rich province of Munster. Desmond, driven to desperation, made a vigorous stand. At one time he possessed himself of the town of Youghal, but was soon afterwards defeated by his old and bitter enemy the Earl of Ormond. At this time a new lord-deputy was sent over in the person of Lord Grey. His first effort was an attack upon the O'Byrnes of Wicklow, who were charged with having banded themselves in alliance with Desmond. He determined to attack them in their stronghold of Glendalogh, in the very centre of the mountains; but, when entangled in the inextricable labyrinths of these mountain fastnesses, he was assaulted with such well-judged fury, that his army was cut off almost to a man, he himself scarcely escaping to Dublin, overwhelmed with shame and confusion. Hence he was soon afterwards called away to Munster. A body of Spaniards seven hundred strong had arrived in Kerry to the aid of Desmond; but the number was too small to be effective. On their landing they secured themselves in an intrenchment, which they named Fort d'Ore. Here they were blocked up by the lord-deputy, so as to render escape impossible. They surrendered, whether on terms or at discretion is uncertain. But the subsequent atrocity is as certain as it is detestable. Lord Grey ordered the whole of the garrison to be butchered. His instructions were executed to the letter. Sir Walter Raleigh, and Spencer the poet, were involved in the infamy of this abominable act, the one as the officer presiding at the massacre, the other as assisting in the councils where it was devised. The war was now at an end, but the chief victim still found means to avoid the indefatigable pursuit of his enemies. Hunted from lair to lair, he suffered all the extremity of famine. A few of his daring adherents had seized a prey of cattle for his sustenance. They were traced into a wooded valley, where, attracted by a light, his pursuers were led to a hovel, in which they found only a feeble old man. On being assaulted and wounded, he called out for mercy, and told them he was the Earl of Desmond. This was the signal for his death. The soldier repeated his blow, and slew him. His head was forwarded to the queen, who ordered it to be fixed upon London Bridge.

The government of Sir John Perrott, who succeeded Lord Grey, presents one of the bright spots in the history of the country. His first act was to publish an amnesty, and to denounce the military slaughters and spoliations which were encouraged by too many of the commanders. He took care to secure all parties in their persons and properties, to administer justice to all alike, and to reform the gross abuses in the public departments. Nor were his endeavours unsuccessful. The natives vied with each other in tendering proofs of loyalty. The old lords of the pale suspended their feuds, and came up to attend his court in Dublin. A parliament was assembled, which, though with some reluctance, passed an act for the attainder of the deceased Lord Desmond, together with an hundred and forty of his followers, and confiscated his immense estate to the crown. Having thus reduced the south to order, he turned his attention to Ulster. Hugh, the eldest son of Matthew, Lord Dungannon, was entitled to the honours and estates belonging to the earldom of Tyrone. He had been educated in England, and had served with honour in the queen's army. He now applied for his seat in the House of Lords, and for the restoration of his property. Perrott granted him the first of these requests, and referred him to the queen as to the second. He therefore presented himself at court, not, like his predecessor, in the wild attire and equipage of an Irish dynast, but as a British courtier. He was received with marked partiality, and soon restored to his possessions. The close of Perrott's government was stained by an act unworthy of him. O'Donnell, the chieftain of Tyrconnel, was suspected of meditating a revolt. Perrott undertook to stifle the attempt without difficulty or expense. To effect this, he caused O'Donnell's eldest son to be inveigled on board a ship sent into Lough Swilly, on pretence of trafficking in wine, and had the young man brought up to Dublin, where he was kept for some time in close confinement. But such had been this governor's general conduct, that even an act so unjustifiable did not deprive him of general confidence. On his recall, being aware of an impending Spanish invasion, he assembled such of the lords and chieftains as were most likely to be swayed from their allegiance by the appearance of a foreign force, pointed out to them the consequences which must result from the apprehended invasion, and persuaded them to give hostages in proof of their determination to adhere to their sovereign. He then quitted the country, followed by the blessings and prayers of thousands. The conduct of his successor, Sir William Fitzwilliam, whose sole object appeared to be the accumulation of wealth, enhanced the feelings of regret for his departure. After the defeat of the Spanish Armada, several of the ships belonging to it were lost on the northern coast of Ireland. Reports were rife as to the quantities of money acquired from the wrecks by the chieftains residing in the neighbourhood. Fitzwilliam seized upon some of them, on the mere suspicion of their being in possession of these treasures, and kept them for years in close confinement. He afterwards imprisoned M'Mahon, the head of the sept that held Monaghan county, on a charge of treason, for having employed a military force to collect his revenues, an usual custom in the Irish districts, and brought him to trial before a jury of soldiers, by whom he was at once condemned and consigned to immediate execution. These and similar severities excited the spirit which they professed to repress. Young O'Donnell, who had been treacherously entrapped by Perrott, found means to escape from Dublin Castle, and took refuge in the mountains of Wicklow, whence, after a year's residence, he made his way, through extraordinary difficulties, to his own country, where he was most active in fomenting the spirit of discontent amongst his neighbours.

About this time the university of Dublin was founded, on the site of a suppressed monastery. The project was first conceived by Sir John Perrott, but it was not acted upon until the time of his successor. It was the only successful effort since the arrival of the English at imparting to the country a knowledge of the higher branches of learning.

O'Neill, ever since his restoration to his estate, had been preparing means for the part he afterwards acted. Amongst the stipulations in his favour on his restoration, was the privilege of being attended with a certain number of armed men. These he frequently changed, so as to have in a short time a large number of his followers trained to the use of arms. When he conceived himself sufficiently prepared to set the English power at defiance, he threw off the mask, and openly laid siege to the fort of Blackwater, built some time before for the avowed purpose of keeping him in check. Sir Nicholas Bagnal was sent to relieve it. The opposing armies met near Armagh. The numbers on each side were nearly equal, but fortune turned the scale of victory. In the heat of the engagement, the explosion of a magazine threw the queen's forces into confusion. The death of Bagnal, who, whilst raising his visor, was shot through the brain, rendered the confusion irremediable. The victory of the Irish was decisive, and fifteen hundred of the enemy fell in the field. The fort of Blackwater immediately surrendered, and Armagh was evacuated by the queen's troops.

Elizabeth at length determined to make one irresistible effort to crush an adversary now become truly formidable. She sent the Earl of Essex into Ireland as lord-lieutenant, at the head of twenty thousand men; a number deemed more than sufficient to accomplish her object in a single campaign. Essex had orders to proceed directly against Tyrone; but he took a course diametrically opposite. He directed his march southwards through Munster, where he found an impoverished and depopulated country, and an enemy that eluded every effort to bring them into decisive collision. In passing through Leix, his cavalry suffered heavily from the repeated desultory attacks of O'More, who cherished all his ancestor's hereditary hatred of the English; whilst another division of his army was defeated by the O'Byrnes of the mountains. In another quarter Sir Conyers Clifford, who was sent into Connaught to create a diversion in favour of the main body, was routed and killed in the Curlew Mountains, by O'Ruark, prince of Breffney, as the county of Leitrim was then called. These repeated losses so diminished the numbers and broke the spirit of the English, that when Essex moved northwards to effect his main object, he found his means inadequate to the attempt. An interview was proposed and accepted, which was followed by a truce for six weeks, in consequence of which the English army returned to its quarters in Leinster.

The anger of Elizabeth at this termination of her expensive expedition was extreme. Essex, to ward off its effect, took the desperate expedient of returning unbidden to court, to justify himself in person. The act was as unfortunate as inconsiderate. He was arrested, imprisoned, and, on a still more frantic effort to excite the citizens of London against the queen, was tried and beheaded.

Sir Charles Blount, Lord Mountjoy, was sent to Ireland in the place of Essex. His love of literature had excited an opinion of his effeminacy. O'Neill exulted openly at the appointment of a man "who would lose the season of action whilst his breakfast was making ready." He was soon to learn that the graces of polite literature are by no means incompatible with the qualifications of a warrior. At the commencement of Lord Mountjoy's proceedings, an occurrence took place which excited in his mind strong doubts of the honesty of the Earl of Ormond, who had still the chief command of the army. This nobleman having allowed himself to be trepanned into a conference with O'More, the chieftain of Leix, on pretence of treating as to terms of submission, was seized and long detained prisoner, as Mountjoy was not over hasty in paying a large ransom for a man who, he shrewdly suspected, had been the secret cause of his own calamity. The proceedings against O'Neill were conducted with much policy. The inferior chiefs were bribed to join in the confederacy against him. Rival claimants were set up against his friends. The lands of those who adhered to him were mercilessly devastated. Pardon was granted to the insurgents only on the condition of betraying or murdering a relative or friend. A strict adherence to these practices soon wasted O'Neill's strength. He persevered in his resistance, however, in the hope of succours from Spain. These at length arrived, but fell far short of what his expectations had anticipated, or the greatness of the emergency called for. Two thousand men, under the command of Don Juan d'Aquila, were all that Philip of Spain would or could spare towards this effort to crush his rival, or at least to dismember her empire. To complete the series of ill-combined arrangements, the invading force landed at Kinsale, in the south of Ireland, whilst the ally whose interests it was sent to maintain was shut up in the northern extremity of the island. The Spaniards, as soon as they landed, were blocked up in Kinsale by the combined forces of the lord-deputy, and Sir George Carew, president of Munster. Don Juan wrote in the most urgent terms to O'Neill and O'Donnell to come to his relief. They advanced at the extraordinary speed of forty miles a day, through a country already desolated by the protracted continuance of a war of extermination. At the same time that they arrived near the scene of action, the landing of a second Spanish armament at Castlehaven, joined to the intelligence that this was to be followed by still further succours, induced several of the southern chieftains to declare themselves openly in favour of the Spaniards; and Mountjoy now found himself blocked up in turn, between the garrison of Kinsale on the one side and the Irish army on the other. Under such circumstances, delay would have been ruin. Famine and disease, already active in his camp, must soon have accomplished the annihilation of his army. The impatience of the Spanish general, and the want of concert among the Irish, saved him. O'Neill was prevailed upon to hazard an attack upon the English lines. In this he was anticipated. Mountjoy, aware of his intention, marched to meet him with part of his forces, leaving the remainder to keep the besieged in check. The enemy were taken by surprise, and, after a short resistance, the main body of the Irish was broken and scattered. O'Donnell, who commanded the rear, fled without striking a blow. O'Neill, after some ineffectual attempts to rally his men, still much superior in numbers, gave up the attempt in despair, and hurried back to the north. The Spanish general, finding himself deserted, and, as he thought, betrayed, by his new auxiliaries, surrendered upon terms. The war of desolation was now carried into the northern province. The forts of Charlemont and Mountjoy were erected to curb the Irish in that quarter. The open country was desolated. Large tracts were converted into deserts, where the miserable remnant of the population endeavoured to support nature by feeding on grass, or the filthiest garbage. O'Neill's friends and adherents gradually fell off. He at length applied to be received into mercy. Mountjoy, at this time aware of the precarious state of Elizabeth's existence, was equally anxious to terminate the struggle. After receiving from O'Neill an abject submission on his knees at Mellifont, he admitted him to pardon, and encouraged him with the hope of restoration to his title and estate. Scarcely had the ceremony been concluded when the news of Elizabeth's death arrived. O'Neill, on hearing of it, burst into a flood of tears, occasioned, as he said, by his regret for a princess whose kindness he had so ungratefully repaid, but, with more probability, by the reflection that an earlier intimation of the event might have enabled him to take advantage of it for procuring terms less degrading. The war could not have been much longer continued. It had worn itself out; the resources of the country were completely exhausted; the population was reduced to the number of from six to eight hundred thousand; the finances were in the most ruinous state; and the debasement of the coin, an expedient adopted by Elizabeth to parry off the ruin, ultimately served only to aggravate the distress.

With the exception of an effort made in the cities of Waterford and Cork to restore the old forms of worship, which was speedily put down with the effusion of but little blood, the submission of Tyrone restored the general tranquillity to such a degree, that Mountjoy felt justified in proceeding to England to present himself before his new sovereign, leaving Sir George Carew in his place as lord-deputy. He was accompanied by O'Neill and O'Donnell, the former of whom was confirmed in his title of Tyrone, and the latter created Earl of Tyrconnel. Before his departure he published a general amnesty, and received into the protection of the English law the whole of the Irish people hitherto exposed to the ill-defined rule of their respective chieftains. But the dawn of tranquillity was darkened by the apprehension of fresh convulsions. An anonymous letter was found in the council-chamber of the castle, hinting at the existence of a conspiracy carried on by some of the great Irish lords against the state. On the alarm being given, the Earls of Tyrone and Tyrconnel, actuated either by a consciousness of guilt, or by an apprehension that they were specially marked out as the objects of persecution, left the country, and took refuge in Spain. Their flight was considered as sufficient proof of their guilt. They were attainted, and their immense possessions forfeited to the crown. In one district of the north the flame of insurrection broke out openly. Sir Cahir O'Dogherty, proprietor of Innishowen, who had hitherto espoused the cause of the English, disclaimed his allegiance, seized by treachery the fort of Culmore, and thence proceeded to attack the town and fort of Derry, which he took by storm, putting the whole garrison, with the commandant, to the sword; but after continuing his ravages for five months, his followers were routed, and himself slain, in an engagement, by Sir Arthur Chichester, the lord-deputy, who found his presence necessary for the complete suppression of the insurrection.

The death of this chieftain and the flight of the two earls having placed nearly the whole of Ulster in the king's hands, he resolved to remodel the province, by removing the ancient possessors, and introducing a colony of English and Scotch settlers in their stead. The tract on which the experiment was to be made comprehended the counties of Tyrconnel, since called Donegal, Tyrone, Derry, Fermanagh, Armagh, and Cavan, spreading over upwards of half a million of acres. The lands were to be portioned out into estates varying from one to two thousand acres, the proprietors of which were bound to build substantial residences in them after the English fashion, and to people them with English and Scotch tenantry. The city of London was peculiarly active in promoting this plan. A company of merchants and undertakers there, under the name of the Irish Society, contracted for large tracts of land, which they still hold under this tenure. The remainder was portioned out amongst private individuals, either English or Scotch, who thus became the founders of most of the principal families now residing in these counties. The order of baronets was instituted in order to promote the execution of this favourite project of James. The number of its members was limited to two hundred, each of whom purchased his rank by the payment of a sum adequate to support thirty men on the new plantation for three years. About the same time, the county of Wicklow, heretofore the property of the septs of the O'Byrnes, and O'Tooles or O'Tothils, was made shire-ground, after the natives had been dispossessed by a summary process, somewhat similar to that employed in the settlement of the northern counties.

In order to secure the permanence of these changes by positive law, a parliament was convoked, after a lapse of twenty-seven years. It was the first to which members from all the counties of Ireland were sent. To secure a preponderance in favour of the crown, a number of new boroughs was created, in the charters of which the right of election was placed in hands which secured subserviency to the ruling power of the day. Notwithstanding this precaution, the political aspect which this assemblage presented was by no means promising. In the upper house, which consisted of but four earls, five viscounts, sixteen barons, and twenty-five bishops, the numbers of the latter order gave the crown an irresistible preponderance. But in the House of Commons the parties were more equally balanced. The election of a speaker served as a trial of strength. The court party proposed Sir John Davis, the attorney-general, an Englishman, and author of the celebrated tract on the Causes why Ireland had never been completely subdued. The country party set up Sir John Everard, an Irish lawyer of respectable family. The election went in favour of the former, by a majority of a hundred and twenty-seven votes to ninety-seven. The defeated party, not content with protesting against the unfair construction of the house, took advantage of the absence of the majority, who had left the apartment for the purpose of being counted on the division, put their own speaker in the chair, and were proceeding to pass resolutions, when the excluded members returned, and, failing in an attempt to eject Everard from the chair, placed their own nominee in his lap. The scene of disgraceful tumult which followed was at length terminated by the secession of the minority, after they had protested against all the acts that should be passed, as informal and unconstitutional.

A commission, issued for the discovery of defective titles, at the head of which was placed Sir William Parsons, a name of no small notoriety in the series of subsequent events, began now to excite alarm. During the long continuance of civil war, the loss of family documents, the neglect of the performance of feudal services, the ignorance of the great proprietors, and the uncertainty of the law fluctuating between English and Irish tenure, brought most persons of property within its fangs, and excited the alarm of all. By means of it the king established a claim of right to upwards of an additional half million of acres. The chief profit of these confiscations accrued to the members and dependents of the government, who employed agents, technically called discoverers, to scrutinize titles and discover flaws, receiving as their reward a portion of the lands charged with being concealed or illegally withheld from the crown. Their success in other parts led them to project the confiscation of the whole of Connaught. The king's claim rested on a case of the most flagrant iniquity. The lands of this province had been surrendered by their proprietors to Sir John Perrott, and restored to them by grants from the queen, to be held under the provisions of English law. Having neglected to enrol their patents in that reign of turbulence and internal commotion, they surrendered them anew to James, and took out new patents, for the enrolment of which a sum of three thousand pounds was paid. The officers of chancery, either through negligence, or from a worse motive, omitted to execute the process of enrolment, and the king, towards the close of his reign, was preparing to take advantage of the *laches* of his own servants, and to seize on Connaught, in order to have it parcelled out anew, as he had done with Ulster. The injured party, aware of their adversaries' power, prepared to avert the ruin which impended over them, by the proffer of ten thousand pounds. Whether the necessities of this extravagant monarch would have led him to the acceptance of that sum for the fulfilment of his part of an equitable contract, cannot now be decided. His death left the question at issue to be handed down to his successor, as one of the ingredients of discontent in the cup of bitterness that he was condemned to drain to the very dregs.

Charles I. began his reign by sending a large force to Ireland, both to provide against the danger of foreign invasion, and to curb internal disaffection; but, through a deficiency of pecuniary means to support the troops, he had recourse to the exertion of his prerogative, and quartered them on the counties and principal towns, obliging the inhabitants to supply them, not only with lodging, but with money and provisions. The murmurs against this oppressive impost were loud and frequent. A meeting of the principal Catholic recusants and great landed proprietors having assembled in Dublin, proposed to Lord Falkland, the lord-lieutenant, to grant the king a voluntary assessment of an hundred and twenty thousand pounds, on a guarantee of security in their rights and properties. The proposal was accepted by the king, who sent over the document containing the required concessions, ratified by his signature, in order to their being confirmed by the ensuing parliament. The principal articles in this covenant, which was known by the name of The Graces, were, that the king's claim to lands should be limited to sixty years; that the Connaught proprietors should receive new patents; that the exactions of the soldiery should be restrained, the fees of the king's officers and the powers of his courts defined, the powers of the ecclesiastical jurisdiction limited, and a general pardon granted for all past offences. When the parliament which was to give the sanction of law to these favours had met, an informality in the writs for assembling was alleged as a reason for not having then confirmed them; and as no new writs were issued, nor any steps taken to convoke another parliament, the people, who had advanced their money on the security of this promise, entertained strong doubts of the king's sincerity. The recall of Lord Falkland served to confirm these suspicions. The lords-justices who were appointed on his departure executed the laws against recusant Catholics with great severity. They caused the celebrated place of penance in Loughderg, called St Patrick's Purgatory, to be dug up and desecrated; and on being resisted by a tumultuous mob in an endeavour to prevent the Carmelite friars of Dublin from publicly performing their religious rites, they seized upon fifteen religious houses, and dispossessed the Catholics of their college in Backlane, giving it to the Dublin university, which kept it open for some time as a Protestant seminary. These measures only augmented the spirit of discontent, to repress which Charles sent over Lord Wentworth, afterwards Earl of Strafford. This nobleman, from being one of the most active leaders of the popular party in the English parliament, became at once the most violent assertor of the king's arbitrary measures. Equally proud and daring, he took no pains to conceal or palliate his desertion. "You see, gentlemen," said he to some of his former political friends, "I have quitted you." "We see you have," replied one of these sturdy republicans;

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"but, with God's blessing, we will never quit you while you have a head on your shoulders." His policy on his arrival was to treat Ireland as a conquered country, and to beat down opposition, from whatever quarter it might arise, by the stern arm of power. His arbitrary conduct made no distinction of persons. The Earl of Kildare having left the country without his permission, for the purpose of laying a complaint against his overbearing conduct before the king, was forced to make an abject submission to the person against whom he complained. Lord Mountnorris, for having used an unguarded expression, which could be distorted into a threat against the lord-lieutenant, was seized, tried by a court-martial, and sentenced to death, and escaped punishment only by the universal outcry raised against such a stretch of power. One Irish nobleman only had courage sufficient to oppose this conduct. Strafford, on the meeting of parliament, had issued orders that the members should lay aside their swords when they took their seats. The Earl of Ormond, who had just come of age, on being stopped at the entrance of the House of Lords, and required by the usher of the black rod to give up his sword, answered, that if that officer must have his sword, it should be through his body, and passed on to his seat. On being summoned before the council to answer for this daring insult on the viceregal authority, he defended himself by saying that he had received the investiture to his earldom *per cincturam gladii*, and was ordered by the writ of summons to attend parliament *gladio cinctus*. The answer, as spirited as it was unexpected, staggered Strafford. He felt that such a spirit in so young a man must either be crushed at once, or otherwise directed. He had the prudence to adopt the latter course; and Ormond, at the age of twenty-four, was admitted into the Irish privy council. The imperious and harsh measures of the lord-lieutenant had, however, the effect of putting down all opposition in parliament. Six subsidies, amounting to three hundred thousand pounds, were granted, and no steps taken to secure to the people, by the sanction of parliament, those graces which the king had pledged himself to grant, and for which they had paid so highly. In some respects Strafford's government was laudable. He reformed the army, so as to render it efficient without being burdensome to the people; he encouraged the linen manufacture, using at the same time every means to depress that of wool; he promoted a spirit of commerce, and guarded the coasts with great vigilance against the annoyance of pirates. Amongst the worst acts of his government, was his project to subvert all titles to estates in Connaught, in order to plant a new Protestant colony in that province. Taking with him a large body of soldiers to overawe the juries, he held courts of inquest to investigate titles. His measures were effectual in four counties. In Galway, the jurors having presumed to give a verdict against the crown, were summoned before the court of the council chamber in Dublin, and the sheriff fined a thousand pounds for returning an improper jury. The exigencies of Charles's affairs induced him to call over Strafford to England, where, after some time, he was impeached by the House of Commons. The principal charges against him rested upon his conduct whilst in Ireland. Several articles were certainly groundless, others exaggerated, but more than sufficient remained to justify the sentence which brought his head to the block, and fulfilled the ominous prediction of the party he had deserted when in the zenith of his prosperity.

Whilst general discontent in Ireland was fermenting through the duplicity of the king, the arbitrary conduct of his officers, the suggestions of his enemies in England, and their bloody triumph over his great agent, a secret conspiracy was forming to rescue the country by force of arms from its present oppressed state, and to restore the property of it to those whom the late changes had ejected. The deviser and main-spring of the plot was Roger Moore, a descendant of the O'Mores of Leix, who had been dispossessed in the reign of Mary. In conjunction with a son of the Earl of Tyrone, who, on escaping to Spain, had obtained the command of a regiment in the Spanish service, he set about procuring the means to accomplish this daring measure. Returning to Ireland, he gained over several of the heads of the old Irish families. The death of Tyrone checked, but did not prevent, his proceedings. Application was made to another branch of the family, Owen Roe O'Neill, then in the service of the king of France, from whom the conspirators received assurances of military aid when matters should be ripe. The seizure of the castle of Dublin was to be the first overt act, and the 5th of October was fixed on for the attempt. The timidity of some of the parties caused its postponement. Roger Moore, after having visited his friends in Ulster, on whose exertions, owing to the severity with which they had been dispossessed in the late settlement of that province, he placed most dependence, came up to Dublin to superintend the attack, which was now fixed on for the 23d of the same month. The lords-justices, Sir William Parsons and Sir John Borlase, were till this moment unaware of the conspiracy, and unprepared for resistance. On the evening of the 22d, information of its existence was given, through Owen Conolly, a Protestant, who had been invited to join in it. Parsons paid little attention to his statement, but Borlase took the alarm, placed guards on the castle and principal avenues, and seized M'Mahon and Lord M'Guire. Moore had sufficient notice of the discovery to make his escape. Dublin was thus saved; but the insurrection broke out with irresistible fury in the north, where Sir Phelim O'Neill, one of the Tyrone family, a man of mean capacity but violent passions, took the lead, by surprising the castles of Charlemont, Dungannon, and Mountjoy. Tanderagee, and the border town of Newry, soon afterwards fell into the hands of the insurgents. Fermanagh was seized upon by a brother of Lord M'Guire, and Monaghan by the M'Mahons. So well organized was the conspiracy, that within eight days' time the Irish found themselves masters of the counties of Tyrone, Monaghan, Longford, Leitrim, Fermanagh, Cavan, Donegal, and Derry, together with some parts of Armagh and Down.

In the mean time the lords-justices were engaged in taking measures for their own security in Dublin. All strangers were ordered to quit the city. Parliament was prorogued. The sheriffs of the counties of the pale received orders to provide for the security of their respective districts. The Catholic lords of the pale attended the counsel, declaring their readiness to assist in the defence of the country. The lords-justices, suspicious of their motives, yet unwilling to irritate them by an expression of doubt, furnished a small supply of arms to those most exposed to danger. After the first burst of an explosion so general and so unexpected, the progress of the insurgents failed to keep pace with their primary exertions. The Protestants in Down took refuge in Carrickfergus. In Fermanagh, Enniskillen set the attempts of the insurgents at defiance, and Lord M'Guire's castle was taken by storm. Sir Phelim O'Neill was driven with disgrace and loss from Castlederg, was defeated in Donegal, forced to retire from before Newry, and again routed at Lisburn, then called Lisnegarvey, with such slaughter that the number of the slain is said to have trebled that of the garrison. These reverses were attended with consequences truly dreadful. The Irish, exasperated by defeat, carried on their hostilities without mercy. The inhabitants of Lurgan, who had surrendered on terms, were seized, and the town plundered. Lord Caulfield, who had been taken in Charlemont, was murdered, with fifty others. Prisoners, whilst removing from one place of confinement to another, were attacked on the road and massacred, or driven into the nearest river. These excesses were not confined to the one side only. The garrison of Carrickfergus fell upon the Catholic inhabitants of the neighbouring peninsula of Island Magee, and forced a number of them over the rocks into the sea. Sir Charles Coote, who was sent out from Dublin to oppose the insurgents, carried on a war of extermination against all suspected of favouring them. That these atrocities did not stain the rebellion at its commencement, but grew out of its progress, is evident from the fact, that no mention of a massacre is made in any of the proclamations issued by the lords-justices, even so late as the 23d of December, three months after its commencement; the protestation of the Irish parliament, which met on the 17th of November, is also silent on the point; nor does any state paper emanating from the Irish government afford grounds for the charge. The parliament, on assembling, sat but for two days. Its only acts were a protestation against those who had taken arms, and the appointment of a committee to confer with their leaders. Alarmed at this act of concession, it was prorogued by the lords-justices; and the conference was broken off in the most indignant manner by O'Moore, when he found himself and his friends stigmatized in it by the name of rebels. The lords-justices now proceeded to deprive these noblemen and gentlemen of the pale of the arms furnished to them in the first paroxysm of terror. Exposed thus undefended to the attacks of the insurgents on the one hand, and to the suspicions of the government on the other, they held meetings with the leaders of the insurrection, first at the hill of Crofty, and afterwards at that of Tarah, in consequence of which they determined to embody themselves as a force distinct from the Ulster Irish, under the command of Lord Gormanstown and the Earl of Fingal, with the professed purpose of confining their operations to self-defence. The lords-justices were alarmed. They now sent to invite the discontented lords and gentry to Dublin, to confer with them on the state of the country. These excused themselves, on the plea that they would not venture within a city under the control of Sir Charles Coote, whose sanguinary speeches at the council board, and massacres throughout the country, had already rendered him peculiarly obnoxious. They also drew up an address to the king, complaining of the injurious conduct of the lords-justices, by which they had been driven to the necessity of arming themselves in their own defence; and they published a manifesto to the same purport, for general circulation. The latter document produced a decisive effect. The insurrection, hitherto confined to Ulster and a small portion of Leinster and Connaught, at once became general. At the commencement of the year the authority of the lords-justices was confined to Dublin and Drogheda, the latter of which was in a state of siege. In Connaught, the town of Galway was retained in its allegiance through the influence of the Marquis of Clanricarde, the king's steady friend. In Munster, the cruelties of Sir Warham St Leger, president of the province, which equalled those of Sir Charles Coote in Leinster, drove even those hitherto well disposed into insurrection.

The arrival of supplies of men from England produced a change, and encouraged the lords-justices to exert themselves to crush their enemies. The means adopted by them were those of extreme severity. The prisoners of the lower orders brought into Dublin were summarily executed by martial law; those possessed of lands were tried by the regular course of law, in order to secure the confiscation of their property. Bills of indictment for high treason were found against all the Catholic nobility and gentry in Meath, Wicklow, and Dublin, and against many in Kildare. Several persons of imputed guilt were put to the torture to extort confessions. The Earl of Ormond, who had the command of the army, received instructions not only to kill all rebels and their adherents, but to burn all the places where they had been harboured, and to destroy all the male inhabitants capable of bearing arms. Nor were these merely denunciations, circulated for the purpose of producing obedience through terror. Sir William Cole's regiment alone boasted, that, besides killing two thousand five hundred men in battle, they had starved and famished, of the vulgar sort, whose goods they seized on, seven thousand. The Earl of Ormond was despatched into the county of Kildare to relieve and secure the castles which still held out for the government. After executing his commission, he defeated at Kilrush a large body of the Irish under Lord Mountgarret; but being unable, through want of supplies, to follow up his advantage, he was forced to content himself by thus securing a safe retreat to Dublin.

On the other side, the arrival of Owen Roe O'Neill gave fresh vigour to the cause of the Irish in Ulster. A Scotch force, which had been sent thither under the command of Lord Leven, remained inactive. Lord Leven, after an empty display, quitted the country, leaving the command to General Munroe, who, following the example of his predecessor, remained quiet in his quarters, whilst the forces of O'Neill were daily augmenting, by the accession of numbers of the natives, and by supplies of officers, military stores, and money, from the Continent.

The insurgents now began to find themselves sufficiently powerful to give form and regularity to their proceedings. A general assembly of delegates from all the provinces was convened at Kilkenny. Their first act was a declaration, in which, after professing their determination to adhere to their allegiance to the king, they disclaimed the authority of the Irish government in Dublin, administered as it was by a malignant party in conjunction with the king's enemies in England. They appointed for the execution of their edicts subordinate councils in the provinces, from which there was to be an appeal to the supreme council of the Catholics of Ireland, a permanent body, consisting of twenty-four members, chosen by the general assembly. Having thus organized their civil constitution, they provided for their military operations by giving Owen Roe O'Neill the command of their forces in Ulster; General Preston, who had lately brought a supply of arms and ammunition from France, in Leinster; Garret Barry in Munster; and Colonel Burke in Connaught. Lord Castlehaven, who, on the first breaking out of the war, had made a tender of his services to the government, but had been refused, having afterwards appeared in Dublin to justify himself from a charge of treason, was thrown into prison, whence he contrived to escape after a confinement of twenty weeks, and was appointed to the command of the Leinster cavalry.

The good effects of system soon showed themselves. Munroe was defeated in Ulster, and the united forces of Lords Muskerry and Castlehaven were successful in Munster. Connaught was wholly in obedience to the confederates; and though Preston had allowed himself to be defeated near New Ross, Lord Ormond found himself too weak to reap any decisive advantage from his victory. Yet, notwithstanding these favourable appearances, the leaders of the confederates, aware of the great superiority of their opponents, and not firmly united amongst themselves, were anxious to put an end to hostilities. But the English parliament obstinately refused to negotiate with those whom they styled rebels and murderers. The Earl of Ormond at the same time undertook to continue the war on the part of the crown, provided the lords-justices furnished

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him with a supply of ten thousand pounds. After much delay, a cessation of arms was acquiesced in by both the belligerent parties, for which the confederates agreed to advance to the amount of thirty thousand pounds for the king's service, one half in money, and the remainder in cattle.

The great object of the cessation of hostilities was to procure from the king a permanent settlement of the country. Both parties sent in their proposals. In these the Catholics asked for freedom of religion, seminaries for the education of their children, a free parliament, from which all who had not property in Ireland should be excluded, and an amnesty for the past. The Protestants, on the contrary, called for the strict execution of the penal laws, the total disarming of the Catholics, the vesting of all estates hitherto forfeited in the crown, and the distribution of them when so vested amongst English settlers exclusively. Charles gave no decisive answer to any of these proposals. He pleaded the difficulties of his situation, and referred them to Ormond, whom he had appointed chief governor instead of Parsons and Borlase, and had raised to the dignity of a marquis. Ormond procrastinated. The mean motives of avarice and personal aggrandizement are charged against him for his indecision in such an emergency. But be the cause what it might, the opportunity for a pacific settlement was let slip, and lost for ever.

The first eventful change was the desertion of the confederate party by Lord Inchiquin, who, on being refused the office of president of Munster by the king, declared for the parliament, and became the bitter enemy of his former associates. Still, however, the confederates had the advantage in several minor encounters, for military operations were not wholly stopped by the armistice. At this period, whilst they refused to furnish the king with supplies either of men or money until their interests were more fully secured than by the temporary stipulations of a truce, and whilst Ormond, on the king's part, resisted every attempt at a permanent peace, the pope's legate, Rinuncini, archbishop of Fermo, arrived, and in his master's name protested against any pacification which did not secure the public establishment of his religion. Charles, pressed by the exigencies of his situation, and unable to overcome Ormond's reluctance, employed another agent. He sent over the son of the Marquis of Worcester, Edward Lord Herbert, better known by the title of Earl of Glamorgan, to which he was soon afterwards promoted, who, through his influence with the confederates, succeeded in persuading them to make a double treaty, the one public, the other private; which latter contained articles insisted on by the Catholics, but deemed to be such as, if generally known, would increase the prejudice against the royal cause in the minds of the English. The secret clauses were, a provision that the members of each religious persuasion should pay their tithes to their own clergy, and that the churches should remain in the hands of their present possessors.

Rinuncini, who, while on his way to Ireland, had obtained from the queen an assurance of terms even more favourable than those of the private treaty, objected to both of them; he also insisted on the publication of the former. His wish was accomplished by an accident. Sir Charles Coote, the second of the name, for the former had been killed in a skirmish soon after the breaking out of the war, having defeated, near Sligo, a body of men commanded by the Archbishop of Tuam, found amongst the baggage of this prelate a copy of the secret articles. The document was immediately transmitted to the English parliament, which lost no time in publishing it throughout all parts of the country. Charles at once denied its authenticity. He declared that Glamorgan had exceeded his powers, and caused him to be arrested on a charge of treason, and examined before the Irish privy council. His duplicity gained him but little credit even at the time, and documents preserved in the public libraries of England have since furnished incontestible proofs of his insincerity. Glamorgan was soon liberated upon bail. The transaction destroyed all remaining confidence between the confederates and the king. Ormond refused to ratify the secret articles. Rinuncini, also, who had private information of the progress of a treaty at Paris between Charles and the pope, insisted on delay. In the mean time, the king's affairs became desperate; and Ormond, when it was now too late, consented to relinquish his objections to the repeal of the penal laws, and concluded a treaty with the confederates. But the want of confidence excited by the king's conduct caused delays in carrying the terms of the treaty into effect, which ended in the utter ruin of the royal cause. Rinuncini, still averse to a compromise which withheld from the Catholic church the enjoyment of any of its former privileges, made party with Owen Roe O'Neill, who, through the aid of the nuncio's money, was enabled to undertake offensive operations, and defeated Munroe at Benburb, a village on the Blackwater. Rinuncini, elated with his success, entered Kilkenny, appointed a new confederate council, and imprisoned the members of the old one. Ormond, in despair, resigned the sword of state, and retired to the Continent; and though he returned again armed with full powers as lord-lieutenant, and though a new general assembly of the confederates, convoked at Kilkenny, had declared themselves favourable to terms in which both parties might be led to acquiesce, and were violent in their protestations against the stubborn resistance of the nuncio, the adoption of any decisive measure was postponed, until all were aroused from their lethargy by the appalling news of the demand made by the parliamentary army in England to bring the king to trial. Then, indeed, the confederates agreed to the terms proposed by Ormond. The leading points were, the free exercise of religion, and the retaining of the churches then in possession of the Catholics until the king's pleasure should be known. Twelve individuals appointed by the general assembly, under the name of the commissioners of trust, were made guardians of the treaty, and vested with powers to levy soldiers, raise money, and perform all acts of supreme authority. The treaty was signed on the 17th of January 1648. But it was then too late. Before the news of its ratification could arrive in London, Charles had forfeited his life upon the scaffold.

Previously to the death of the king, no less than five armies were maintained in Ireland, each acting for a different object. The Marquis of Ormond commanded that of the king, for the purpose of restoring him to his government. The parliamentary forces, under Colonel Jones, had possession of Dublin; and in the south he was supported for some time by a force under the Earl of Inchiquin. General Preston commanded the troops of the confederate Catholics in Leinster. Owen Roe O'Neill, who had attached himself to the nuncio, and therefore was equally opposed to the king, the parliament, and the confederates, had the command of all Ulster, except a small portion of its eastern extremity, where Munroe was at the head of an army which favoured the Scotch. All these elements of intestine commotion were again thrown into action by the king's death. Rinuncini, indeed, finding that this event, which he was charged with having hastened by his obstinacy and violence, had alienated the whole of the Catholic population, quitted the country privately. Ormond then endeavoured to gain over O'Neill, but failed; he afterwards made overtures to Colonel Jones, with whom he was equally unsuccessful, his proposals being met with the retort that his suspicious conduct had been the cause of exciting the apprehensions of the king's insincerity, which prevented any of the parties in Ireland from coalescing with him sincerely, and thus led to his destruction. Having at length, from his own resources, collected an army sufficient to take the field, he invested Dublin, with the intention of reducing it by famine. But an advanced post at Baggotsrath having been successfully assaulted by a sortie from the garrison, which followed up its success by an attack on the marquis's head-quarters at Rathmines, the whole besieging army was seized with such an unaccountable panic that it dispersed in all directions, leaving the general so utterly deserted, that when he wrote to Jones respecting the prisoners who had fallen into his hands, this officer's taunting reply was, that he did not know where to find his lordship in order to wait upon him on the business.

Before the marquis could recover from the effect of this defeat, news was brought him of the arrival of Oliver Cromwell in Dublin, with a select and well-appointed army of ten thousand men. After a short delay in that city to refresh his troops and to regulate the civil affairs of the country, Cromwell proceeded to besiege Drogheda, which Ormond, suspecting his intention, had provided with a good garrison, and abundance of military stores. After having made a practicable breach, the assault was given, but the besiegers were twice repulsed. On the third attack, led on by Cromwell in person, his troops forced their way into the town, and the garrison laid down their arms on promise of quarter. The promise, however, was kept only as long as resistance was apprehended; for as soon as the place was completely reduced, orders were issued for the indiscriminate massacre of the inhabitants, without distinction of age or sex; which were so punctually obeyed, that thirty only survived, who were forthwith transported as slaves to Barbadoes. From Drogheda Cromwell proceeded southwards to Wexford, which being well garrisoned and provided, was expected to make a long resistance, so as to give time to Ormond to collect his forces from other quarters. But it was betrayed by the treachery of the officer placed in command of the castle, and, when taken, treated with the same merciless cruelty as that which had before marked Cromwell's triumph at Drogheda.

The effect of these terrible examples of severity in paralyzing opposition, was increased by the orders given by Cromwell to his troops to abstain from any wanton injuries on the peaceable peasantry, and to pay them in full for all their supplies; a system directly contrary to all former practice, according to which, the soldier, whether friend or foe, was ever the peasant's terror.

The only hope for the royalist party now rested in the cordial union of Ormond and O'Neill. Both were sensible that a junction of their forces was absolutely requisite to counteract the movements of Cromwell. To effect this object, O'Neill moved southwards with his army, but was seized on his march with a defluxion of the knees; a complaint attributed at the time to a pair of poisoned boots prepared for him by an agent of the confederates. Unwilling to retard the movements of the armies, he had himself conveyed in a litter, but sunk under the accumulated pressure of disease and fatigue, and died at Clough-outer Castle.

The commissioners of trust were so much alarmed at the treatment of Drogheda and Wexford, that they were with difficulty prevented, by the remonstrances of Ormond, from abandoning Kilkenny. The want of confidence which he experienced, both from the leaders of the confederates, and the inhabitants of several of the large towns in the south, tended much to embarrass him. The city of Waterford absolutely refused admission to his troops, even at a time when a passage through it was required to make a successful assault on the retiring army of Cromwell. This general commenced the campaign in 1650 by a movement on Kilkenny, which was to have been betrayed into his hands. But the plot being discovered, and the traitor executed, he was forced to lay regular siege to the place. It made a very gallant defence. After a breach had been effected, the besiegers were repulsed in two attempts, and Cromwell was preparing to retire, when he received secret information that the town magistrates were anxious to surrender. A third assault was then made, with as little success as the former; but Ireton having come up with a fresh supply of men, and the garrison having been informed that no assistance could be afforded them from without, the town surrendered on terms highly honourable to its defenders, who, on marching out, were complimented by Cromwell for their gallantry, and told, that had it not been for the treachery of the town's people, he must have raised the siege.

Clonmell still held out against the parliamentary army. The garrison was commanded by Hugh O'Neill, another branch of the family which had signalised itself in the wars of Ireland. The first assault was repelled with such slaughter that the infantry refused to advance a second time, and Cromwell was compelled to bring forward his own favourite regiment of cavalry. These succeeded in entering the breach, but met with an opposition so fierce and so unexpected, at a retrenchment thrown up within, that the greater part of the storming party lay dead or wounded on the spot, and the remainder evacuated the place. In the two assaults Cromwell lost two thousand of his best soldiers. Not daring to venture on a third, he changed the siege into a blockade. The Marquis of Ormond, aware of the importance of the place, made every exertion for its relief. Assisted by the Catholic bishop of Ross, he collected a numerous but tumultuary body of men in the western part of Cork. These were attacked and routed, and the bishop taken. His life was promised to him, provided he would prevail on the garrison of a neighbouring fort, which greatly annoyed the besiegers, to surrender. On going thither, he exhorted the garrison to persevere in their defence, and, on his return to the camp of Cromwell, was executed. O'Neill having defended the town as long as his ammunition lasted, withdrew his troops by night unobserved; and Cromwell, unaware of the movement, gave the people very favourable conditions, to which he was the more inclined, as the intelligence of Charles II. having taken refuge in Scotland, and the hostile indications from that quarter, rendered his presence in England necessary to his party. Immediately after the surrender of Clonmell, he proceeded to Youghal and embarked for England, leaving the army in charge of his son-in-law, Ireton.

All rational hope of successful resistance to the parliament was now at an end. Ormond prepared to quit the kingdom. The commissioners of trust for some time opposed his intention, conscious of the confusion which must arise from such a public avowal of his despondency. But with the Catholic clergy it was otherwise. They suspected that he was secretly negotiating with Cromwell. His former conduct afforded plausible grounds for such a suspicion; and during the siege of Clonmell he had procured passes from that general for himself and Lord Inchiquin to go to England. A synod of the bishops, held at Jamestown, resolved upon sending a deputation to him, calling upon him to quit the country, and transfer his powers to some trustworthy person, who enjoyed the confidence of the nation. A second resolution denounced excommunication against all who should hereafter adhere to him. Whilst the relics of those who professed attachment to the royal cause were wasting their strength and ruining their prospects by these proceedings, Ireton was engaged in extending his authority by the reduction of

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one place of strength after another. Ormond, as a last resource, convened a general assembly at Loughrea; but the party of the clergy was too powerful. Finding all means ineffectual to induce them to recall their hostile declaration, he embarked in a frigate provided for him by the Duke of York, transferring his powers as lord-lieutenant to the Marquis of Clanricarde. An extraordinary negotiation was now commenced with the Duke of Lorraine, by which it was proposed, that on the advance of a large sum of money, and a proportionate supply of military stores, he should be declared protector of the royal cause, and receive some towns as cautionary securities. But the rapid progress of Ireton baffled all these projects. Limerick was reduced, partly by the effects of a pestilential disease, partly by treachery. Amongst the victims of the plague was Ireton himself. After his death, Galway surrendered to Ludlow, his successor. A last desperate attempt at resistance was made in Connaught by Clanricarde, aided by Sir Phelim O'Neill, who now again began to make himself conspicuous. It was defeated, and Clanricarde fled to one of the islands on the coast. Sir Phelim was taken prisoner, and ultimately executed as a traitor. The nuncio's party sent ambassadors to offer the crown of Ireland to the pope, the kings of France and Spain, and the Duke of Lorraine; but none of them would accept the worthless bauble. Clanricarde still endeavoured to maintain a mountain war amidst the glens and wastes of western Connaught. It was but the expiring effort of unbending loyalty. At length a letter from Charles, recommending him to provide for his own safety, released him from the shackles of the self-imposed bonds of loyalty. He applied to Fleetwood, Cromwell's deputy, for a pass to retire to England. It was granted, and he submitted to the parliament on an assurance of not being called upon to perform any act inconsistent with his duty to his sovereign. Shortly afterwards, a proclamation from the English parliament announced the termination of what was called the rebellion in Ireland.

The victors had now only to share the spoil. The greater part of the nobility and gentry of Ireland, and of the army, had expatriated themselves; the estates of the confederates were deserted. It remained to apportion them amongst the friends and followers of the parliament, in such a manner as would best secure a zealous attachment to the new order of things. The ordinance of the English parliament to this effect decreed, that all who had been concerned in the rebellion previously to the 10th of November 1641, all Jesuits and priests, all who, not being themselves in arms, had slain English soldiers, and all who, being now in arms, did not lay them down within twenty-eight days, should be excepted from pardon. The Marquis of Ormond, the Earls of Inchiquin and Roscommon, and Bramhall, Protestant bishop of Derry, were also specially excepted. All persons who had borne a command against the parliament were to be banished during pleasure, to forfeit two thirds of their estates, and to be assigned lands to the value of the remaining third wherever the parliament should appoint. All Catholics who had resided in Ireland at any time during the war, and had not manifested their constant good will to the commonwealth of England, were to forfeit one third of their estates. All others residing in Ireland, as before, who had not been in arms for the parliament, or manifested their good will towards it when an opportunity offered, were to forfeit one fifth.

A high court of justice, somewhat of the nature of a court-martial, being composed of parliamentary officers, who acted in the double capacity of judges and jurors, and whose decisions were not regulated by any settled rules of evidence, sat on the cases of delinquency. Yet, after the severest scrutiny, the number of those subjected to the penalties of the first clause of the instructions was very small. Lord Mayo in Connaught, and Colonel Bagnal in Munster, were condemned, as it was thought, unjustly. Lord Muskerry was saved by the evidence of the numerous English settlers, who pressed forward to vouch for the protection and security they enjoyed under his control. In Ulster, Sir Phelim O'Neill was the only victim. Although offered not only pardon, but restoration of property, if he could produce substantial proof that he had had a commission from Charles to commence the insurrection, he disclaimed the fact, and died maintaining the contrary. Of others, not quite two hundred could be found who came within the strictness of the clause, so much had the accounts of the atrocities committed at the breaking out of the insurrection been magnified, or so completely had the actors in it been swept off by the desolation of the hostilities that succeeded.

The disposal of the forfeited lands was regulated according to the principles of an act of the English parliament, by which those who at the commencement of the war had subscribed L.200 towards the reduction of Ireland were to have 1000 acres in Ulster; those who had subscribed L.300, the same number in Connaught; and those who had subscribed L.450 and L.600, a like quantity of land in Munster and Leinster. The holder of the lands thus granted was bound to pay a yearly quit-rent to the crown, of one penny an acre in Ulster, three halfpence in Connaught, two pence in Munster, and three pence in Leinster. The soldiers who had served in Ireland since the landing of Cromwell there in 1649, were entitled to a share of the lands in lieu of their arrears, on the same terms as those who had advanced money, and who were distinguished by the name of adventurers. Those who had served previously to that date were to look for payment to the residue of lands which might be over and above after the former division had been made; a kind of security which was found to be very deficient. In order the more effectually to secure the new possessors in their properties, the Catholics who should be found entitled to retain any part of their estates under the provisions of the act above specified, were to surrender such part if in any of the other provinces, and to receive an equivalent, or, as it was called, "to be reprized," by waste lands in Connaught, which new allotments were assigned in the parts of the province situated at least a mile from the coast. No Catholic was, under any condition, to be suffered to remain in a town, or within a certain space around it. By the latter part of this provision, it was intended to cut off the Irish from any communication with foreigners, as by the former the broad boundary of the Shannon separated them from any contact with the residents in other parts of the kingdom. Commissioners of delinquency sat at Athlone, to decide upon the qualifications of the Roman Catholics; others, appointed to arrange the details of settlement of those transplanted to Connaught, held their court at Loughrea. A third body of commissioners met in Dublin, to receive and hear claims. Under their direction a survey was made by the celebrated Sir William Petty, of all the forfeited lands, which, notwithstanding the lapse of time, and the state of the country when executed, is found to be singularly correct in its details. The confiscation comprehended by much the greater part of the surface of Ireland, and threw the property, and consequently the influence, of the country into the hands of a new class of men. Private soldiers, or desperate adventurers, now became the lords of extensive tracts, once enjoyed by the native families of ancient descent, or by the Anglo-Irish nobility. It also produced another change, of less striking character at first, but of overpowering influence on the future destinies of the country. The land was likely to be useless for want of cultivators. The continuance of a warfare, in which mercy was deemed a symptom of timidity or

History. of treachery, had swept away the peasantry in multitudes. Numbers had been transported as slaves to the plantations; many had emigrated as soldiers or colonists. The plan of peopling the wilds of Connaught by transplanted Catholics was almost totally relinquished. Hands were wanting on the new estates; the tenants were therefore retained, but they were treated with all the jealous severity arising from a consciousness of weakness, and an apprehension that advantage would be taken of it. They experienced the harshness of slavery, without the enjoyment of that protection which the selfishness of ownership in some degree spreads over it.

The government of Ireland was intrusted by Cromwell to his son Henry, who proved himself worthy of the choice. He visited most parts of the island, so as to make himself personally acquainted with its resources and capabilities. He checked the frauds attempted to be committed by the commissioners in the disposal of the forfeited lands, repressed the violence of the soldiery, and afforded the protection of the law to the ill-used peasantry. He had even devised plans on an extended scale for the improvement of the country, which the short duration of his power prevented him from executing. Impressed with the necessity of diffusing knowledge as the surest foundation for the solid advancement of the people, he purchased the library of Archbishop Usher, in order to bestow it on a second college which it was intended to found in Dublin. Amongst other plans for the consolidation of the interests of the two countries, it was intended that Ireland, instead of being governed by a domestic parliament, should send representatives to that of England. The number fixed upon was thirty. But the death of Cromwell, and the resignation of his son Richard, put an end to all these well-intended projects. On the announcement of this latter event, the English parliament, aware of Henry Cromwell's abilities and popularity, and apprehensive of an attempt on his part to maintain himself in the government, sent over Sir Hardress Waller to seize upon the castle of Dublin; but the precaution was unnecessary. Cromwell retired without opposition, remaining in privacy in his house in the Phœnix Park until he had provided himself with the means of removing to England, having administered the government with so much disinterestedness during a period in which he had the means of amassing unlimited wealth, that he could not at once defray the expenses of his passage over.

The thoughts of the new settlers, who were now transformed from needy adventurers and soldiers into landed proprietors, began to turn upon the means of securing the properties so unexpectedly acquired. The agitation consequent on the death of Cromwell, whose overruling master-mind had hitherto kept all parties subservient to his views, began to take a turn decidedly favourable to the restoration of royalty. The great leaders of the parliamentary party perceived this, and prepared to shape their course accordingly. Lord Broghill, who had already changed from a royalist to a republican, was the first to retrace his steps. He was followed by Sir Charles Coote, the most sanguinary of the parliamentary leaders. The towns of Youghal, Bandon, and Kinsale, which had been amongst the first to revolt to Cromwell, were now led by Lord Broghill to declare for the king. Coote secured Galway and Athlone. The same party, after a short struggle, seized upon Dublin Castle. Sir Hardress Waller, who had taken possession of it for the parliament, was sent a prisoner to London; and Ludlow, who, upon the alarm of the change of sentiment in the parliamentary party in Ireland, had been sent over to take the chief command, on arriving in Dublin Bay, was prevented from landing, and forced to return to England. A convention was assembled in Dublin. The council of state in England ordered its dissolution. The order was set at defiance. The king's declaration at Breda being presented to the convention, was accepted by acclamation, and Charles was proclaimed with every demonstration of joy in all the great towns. Thus, the restoration of the son in Ireland was effected by the same persons who had been mainly instrumental in bringing his father to the block.

The sudden change of public opinion gave Charles irresistible influence in Ireland. All parties looked to him. Above all, the Catholics, whose attachment to his father had been the great cause of their sufferings, and of the ruin of their property, anticipated an immediate restoration of their estates. So sanguine were they, that many proceeded to take forcible possession of them, and to eject the new proprietors. The Protestants raised the cry of a new rebellion, employed agents in London to resist their claims, and had influence sufficient to obtain clauses in the act of indemnity, excluding from it all who had at any time aided the Irish, and prohibiting the restoration, upon any terms, of lands already disposed of by the parliament or convention. Nor was it without the greatest difficulty that an exception could be carried in favour of the Marquis of Ormond and other Protestants. Every severe ordinance against the Catholics was strictly enforced. The commoner sort were prohibited from quitting their place of residence without permission. Assemblies of the Catholic gentry were forbidden. A proclamation was issued for apprehending Irish rebels, and for assuring all adventurers and soldiers in the quiet possession of their grants.

At length the king's declaration, which was to form the basis of the new settlement of the landed property of the country, was published. This document, after vesting all the confiscated property in the king, confirmed the adventurers and soldiers in the lands already granted to them. The officers in the king's service before 1649, distinguished by the name of "Forty-nine Men," were to receive their arrears in lands at the rate of twelve and sixpence in the pound, and an equal dividend of whatever should remain of their security. Protestants whose estates had been given to adventurers were to be restored, and the present holders "reprised," that is, given other lands of equal value. Innocent Papists were also to be restored, and the holders reprised; those restored to property within corporate towns were to be reprised in the neighbourhood, as no resident Catholics were to be permitted in those places. Such Catholics as had accepted lands in Connaught were to continue bound by that act. Those who had joined the king in his exile, and served under his banners, were to be restored when the present holders were reprised; such persons were called "Ensign-men." Additional grants were made to Ormond and Inchiquin, who had been restored by the English parliament. Monk, now Duke of Albemarle, and some others, received grants. The king's brother, James, duke of York, had several of very great extent. Thirty-six of the Irish nobility and gentry, to be specially named by the king, were also to be restored under the title of "Nominees." Those who had any share in the trial and execution of the late king were specially excluded from the benefit of this arrangement. Lands belonging to corporations were to be restored, and the possessors reprised. The qualifications which entitled a Roman Catholic to claim the benefit of the clause respecting "innocent Papists," were so worded as to render the chances of an acquittal almost impossible. None were to be restored as such, who, at the time of the cessation in 1643, had been of the royal party, or had lived within the quarters of the confederates, except the inhabitants of Cork and Youghal, who had been forcibly expelled from those towns, and driven by the fanatics into the enemy's lines; who had acted with the confederates before the peace of 1648, or had adhered to the nuncio or the papal power against the royal authority, or, when excommunicated for such adherence, had submitted and obtained absolution. Whoever derived his title from persons guilty of those crimes; whoever claimed his estate on the articles of peace, thus acknowledging his concurrence in the rebellion; whoever had held correspondence with the confederates, sat in their councils, or acted under their commission; whoever had employed agents to treat with any foreign power to bring forces into Ireland, or had been a tory, the name given to the marauding parties which harassed the country; were also excepted. Few Roman Catholics could hope to escape being included in some one or other of those sweeping clauses.

The principal subjects which engaged the attention of the Irish parliament that met after the Restoration, were the established church, and the settlement of property. Ormond, to whom the management of Irish affairs was principally intrusted, contrived, by postponing the consideration of the question of the lands, to secure the adoption of the former. Although the House of Commons was almost exclusively composed of those who had a few years before been most zealous in pulling down the church and abolishing the liturgy, it now not only readily assented to the revival of both, but concurred in censuring the solemn league and covenant, and in condemning their former oaths of association. They also procured an order from the lords-justices to adjourn the law term, and close the courts of justice, in order to prevent the reversal of outlawries, or the ejectment of adventurers and soldiers before their titles could be secured by statute.

The act of settlement, the next object of parliamentary attention, was framed according to the spirit, and nearly according to the letter, of the declaration published by the king. The principal alterations were respecting reprisals, and what was called the doubling ordinance. The commissioners of the court of claims had been guilty of gross partiality respecting these. They rejected the claims of the nominees, and the ensign-men, on the plea that there were not lands sufficient to reprise the present possessors, a defalcation caused by the clandestine disposal by themselves of these lands to their own friends. Through the exertions of the House of Lords, a clause was inserted for the revocation of these fraudulent grants. The doubling ordinance was still more pregnant with injustice. The English parliament having found that the sums subscribed by the original adventurers had fallen short of the amount required to finish the war, and being in want of further supplies, passed a law, that whosoever advanced one fourth more than his original share, should be entitled to as much land as if he had actually doubled his subscription; and that if any adventurer refused to make such advance on his original share, any other person, on paying it, should reap the benefit of the doubling clause, provided he repaid to the adventurer the sum at first subscribed. With great exertions, and by the determined interference of the Earl of Kildare, it was at length determined that the adventurers should receive lands for the money actually advanced by them, and no more. The Irish parliament, however, could only frame heads of a bill to this effect, which was liable to be modified by the king and privy council in England. Thither, therefore, all parties interested sent agents to defend their respective claims. London became the scene of controversy, intrigue, cabal, and even violence. The Irish called for the fulfilment of the articles of the peace of 1648. Ormond, who hated the Catholics even more than he did the regicides, persuaded the king that such fulfilment would be detrimental to his favourite scheme of maintaining an English interest in Ireland. Richard Talbot, afterwards Lord Tyrconnel, the advocate of the Irish, finding reason and justice ineffectual, challenged Ormond. The latter made his complaint to the council; Talbot was committed to the Tower, and detained there till he made an humble submission. The bill, with all its clauses, received the royal assent, and was sent back to Ireland, where it was adopted by both houses of parliament.

But the passing of the act was not sufficient to render it operative. Every one was dissatisfied with it. Even the adventurers, whose interests were best guarded by it, exclaimed against it most loudly. They considered the rejection of the doubling ordinance as the deprivation of so much of their justly purchased property. The land granted to the nominees, the number of whom had been increased by the king, was looked upon as so much cut off from the common fund whence they were to be repaid. The restoration of church property was peculiarly galling to their religious prejudices. The Protestant officers felt that their security was greatly diminished by large grants lavishly made to some of the king's special favourites. The Catholics complained that, so far from having justice done to their services, their agents were not even admitted to plead their cause before the council.

Ormond, now elevated to the rank of a duke, was sent over as lord-lieutenant to calm these effusions of anger, and to settle in the most amicable manner the conflicting interests of the parties. The first proceedings were those of the commissioners of innocency, who soon found that the number of those who could clearly establish their innocence, even before a court cautiously and carefully composed of Englishmen and Protestants, was inconveniently great, and excited the most serious alarm amongst the other party, who felt that every acquittal abstracted so much from the fund to which they themselves had to look for a settlement. Out of a hundred and eighty-seven cases adjudicated in the first three months, a hundred and sixty-eight were pronounced innocent, and but nineteen condemned. The House of Commons called upon the lord-lieutenant to make the qualifications more rigorous. The more violent of the old parliamentary soldiers laid a plan for a general insurrection. Ormond was steady. He put down the conspiracy, and executed a few of the ringleaders. He refused to make any change as to the qualifications. But he contrived to effect, by an evasion, what a regard for consistency of character had made him reject in public. Upwards of four thousand cases had been entered, and, from the number already decided, and the character of the decisions, it was felt that by much the greater proportion of the Catholic proprietors would be restored to their estates. To prevent such an occurrence, the time of the sitting of the court was limited to a fixed number of days, during which not more than one fourth of the claims could by any possibility be heard. It then closed, and thus upwards of three thousand ancient and respectable Irish families were stripped of their fortunes, without even the form of a trial before a court specially constituted to do them justice. The injured parties applied to the king; but he refused to listen to them, and they were irremediably ruined. Though their claim was rejected, however, its justice was recognised by a concession, and the lord-lieutenant was permitted to select twenty out of the three thousand, to be restored to their estates as objects of special favour.

To remedy, in some degree, the defects of the act of settlement, a bill was brought into parliament, chiefly by the instrumentality of the Duke of Ormond, which made a few alterations in some of its most obnoxious provisions. This is known by the name of the act of explanation. The two together form the tenure under which by much the greater part of the landed property of Ireland is held; they have therefore been quaintly, and with more regard to their binding force than their justice, styled the Magna Charta of the Protestants of Ireland. To account for the Duke of Ormond's conduct towards his former friends, to whom during the war he owed so much, and his master every thing, and his sacrifice of their interests to the bitter enemies both of himself and the king, it may be sufficient to mention, that his estates, which, before the breaking out of the civil war, had yielded but about L.7000 per annum, now brought him in a yearly income of upwards of L.80,000, in addition to the pecuniary grants made him for losses during the disturbances. The acts which ruined so many of the adherents to the royal cause secured him in the undisturbed enjoyment of this princely income.

Notwithstanding the apprehensions arising from the still uncertain state of title, the condition of the country began to improve with a rapidity alarming to the English, who were now suffering through a decline of their domestic trade, which prejudiced persons imputed in a great degree to the excessive importation of Irish cattle. To prevent the supposed ill effects of this, acts were passed prohibiting the Irish from sending cattle or provisions into England after the first of July, which exclusion was afterwards extended to all periods of the year. So strong was the prejudice, so powerful the alarm, that when the Irish parliament, through a wish to alleviate the sufferings of the people of London after the great fire in that city in 1666, sent them a free gift of thirty thousand oxen, the only wealth of the country at the time, the well-intended donation was rejected, as an attempt to evade the prohibition under the mask of benevolence. The king endeavoured to alleviate, though he was too weak and too timid to prevent, this impolitic act of injustice. He issued an act of state, permitting the Irish to export to foreign countries all commodities of their own growth and manufacture; and the Duke of Ormond, on his part, encouraged the woollen manufacture, for which the country was peculiarly fitted, from its capability of rearing sheep, and its water-power for machinery. He brought in foreigners acquainted with the processes of the manufacture, established a board of trade in Dublin, and encouraged factories on the Suir. His attention was also directed to the improvement of the linen manufacture. But his laudable efforts were thwarted by his enemies at court, who persuaded Charles to recall him. Lord Robarts, who was appointed in his place, rendered himself so offensive to all parties, that he was soon removed, and his place supplied by Lord Berkeley, who was also as speedily withdrawn, in consequence of his being active in procuring a commission of inquiry as to frauds practised on the Catholics in the adjudication under the act of settlement. The government of Lord Essex, his successor, was equally short-lived; and it was found necessary to restore Ormond, as the only person sufficiently acquainted with the state of parties in Ireland, to manage the country without danger of a sudden explosion.

Shortly after his return to office, the Popish plot occurred. The devisers of this execrable contrivance endeavoured to involve the Irish in a share of the guilt. Charges were made against Talbot the Catholic archbishop of Dublin, Lord Mountgarret, and Colonel Peppard, as being principals in it. On investigation, the first of these imputed conspirators was found to be labouring under a complication of disorders, beneath which he soon afterwards sunk; the second was bedridden through age; and the third was entirely unknown. The Duke of Ormond, more probably through a conviction of the necessity of yielding something to popular clamour, issued two violent proclamations. The one required the relations of tories to be answerable for them, and also that the priests of parishes in which a robbery or murder had been committed should be transported, unless the offender were delivered up to justice within a fortnight; the other prohibited Catholics from entering Dublin Castle, or any fortified place, and caused all fairs to be held without the walls of cities and corporate towns. But restraints, however rigorous, were not sufficient. The bigotry of the time called for a victim. Plunket, the Catholic archbishop of Armagh, was accused of being the instigator of a plot to raise seventy thousand men to overturn the government. He was sent to London, tried there for a crime committed in Ireland, denied either time or means to bring over witnesses, condemned as a traitor, and executed at Tyburn, professing his innocence to the last. The only subsequent act of Charles's reign, of consequence enough to merit notice, was a second attempt to deprive Ormond of his power. And it proved successful. Partly from a plea of his advanced age and increasing infirmities, partly from a necessity avowed by the king of removing from office several of his friends, the sword was taken from him and assigned to his relative Lord Rochester.

All the political arrangements consequent on the accession of James II. indicated a settled and systematic determination to disturb, if not wholly to nullify, the provisions of the act of settlement. Talbot, afterwards Earl of Tyrconnel, was placed over the army, which he immediately began to new-model, by cashiering and disbanding most of the Protestants, and bringing Catholics into their places; and by disarming the militia, which consisted chiefly of Protestants, under the plea that they were suspected to have been connected with Monmouth's rebellion. These apprehensions were still further increased by the promotion of Tyrconnel to the chief government. The first overt act was made against Dublin College, by nominating a Catholic to the professorship of the Irish language, which was defeated on the ground that no such professorship existed. An attempt made to appoint a Roman Catholic to a fellowship was frustrated by the gross incapacity of the person recommended.

The king's attempts against the Irish corporations were more successful. In order to carry into effect all his changes, the sanction of an Irish parliament was necessary; and to effect this, it was equally necessary to secure a majority in the boroughs, in which the Protestant interest had hitherto been almost exclusively predominant. Tyrconnel caused all the charters of these bodies to be seized into the king's hands, on the plea of violation or non-performance of conditions, and granted new charters, so arranged as to throw the whole of the borough influence into the hands of the Catholics. A few of the corporate bodies still hold under these charters; but the great majority of them having been passed after the abdication, are considered as of no authority in the courts of law.

On the landing of the Prince of Orange in Torbay, Tyrconnel received orders to send over four thousand men to England. So little prepared was he at the time to meet the exigency, that he found it necessary to withdraw the garrison from Londonderry in order to make up the number. But he soon became sensible of his error. The Protestants in the northern counties had already been roused to a movement of self-defence, in consequence of an anonymous letter sent to Lord Mount-Alexander, warning him of the intention of an immediate insurrection to extirpate them. Just at the time, a Roman Catholic regiment, lately raised by the Marquis of Antrim, had been ordered to Derry in room of the troops sent to England. The appearance of the men, now approaching the town, noway tended to diminish the feelings of alarm already excited by the previous warning. The first division of the newly-arrived regiment was within a few hundred paces of the town, when several young men, said to be apprentice boys, hurried armed to the gate, shut out the soldiers, hastened to the walls, pointed the guns, and threatened them with destruction if they attempted to force their entrance.

This decided act of the people of Derry was followed up by all the northern Protestants. The town of Enniskillen was secured in a similar manner, and armed associations were formed throughout every part of the province, to maintain the Protestant religion, and secure the dependency of Ireland. The first act of these bodies, after providing themselves with the means of resistance, was to apply to William. But he had already opened a treaty with Tyrconnel, to whom he sent General Hamilton, then prisoner with him, under a promise, that if he failed in gaining over Tyrconnel, he himself should return. Hamilton's conduct on the occasion was inexcusable. Instead of using arguments to persuade Tyrconnel to submit, he encouraged him to persevere in the cause of James, and remained with him instead of redeeming his parole, and proved his zeal in the cause he had thus faithlessly adopted, by heading a body of troops in Ulster, by which the whole province, with the exception of Derry and Enniskillen, was brought again under its allegiance to its former king.

James soon afterwards landed at Kinsale with a small body of French forces, having declined the aid of a more powerful armament, from a wish to be indebted for his restoration to the unassisted loyalty of his own subjects. On arriving at Dublin, he was welcomed with loyal addresses from all ranks and classes, amongst which the Protestant clergy were not less forward than others in their professions of zealous attachment. Finding himself at the head of what he considered as an unanimous people and a large army, his first movement was the reduction of the city of Derry, which, instead of listening to terms offered by Tyrconnel, resolved upon an obstinate resistance; expelled the governor set over the city by the king, upon a well-founded suspicion of intended treachery on his part; marshalled themselves in regiments; chose for leaders in this desperate attempt, George Walker, a clergyman of the established church, who had already signalized himself by raising a regiment of a thousand Protestants, and Major Baker; and, turning their guns against James, who, from a mistaken reliance on his personal influence, had approached the walls, compelled him to retire. The sword was now drawn between king and subject. The men of Derry had not only renounced their allegiance to their sovereign, but defied his power and insulted his person. James, convinced of the irresistible force of the numbers brought against the place, and of the futility of their means of resistance, their numbers not being more than seven thousand men, and these undisciplined and badly armed, the place unprovided with military stores, or even sufficient quantity of provisions, and the defences by no means adequate to resist the advances of a well-organized besieging force, returned to Dublin, leaving the conduct of the siege to Marshal Rosen, who had been a German officer in the French service. After some feeble attempts at gaining the town by storm, Rosen adopted the surer though more tedious method of blockade. The inhabitants were soon reduced to extreme privations, yet still they adhered to their determination of holding out. After upwards of two months suffering, they were cheered by the appearance of a fleet sent by William to their relief; but, after an empty display of assistance, Kirke, who commanded it, sailed away to Lough Swilly, where he employed his time in sending supplies to Enniskillen, which stood less in need of them. Still the garrison persevered in its defence. Rosen, enraged at their obstinacy, ordered all the Protestants in the neighbouring districts to be driven under the walls, in order to expedite the extremity of famine. The townsmen, in retaliation, prepared to hang up all the prisoners on the town walls. An express order from James forced the besieging general to relinquish this inhuman device for augmenting the horrors of war. The wretched sufferers were allowed to return home, and the town's people adroitly seized this opportunity of recruiting their strength, by taking in some of the younger and more vigorous, and sending away in their stead those exhausted by the hardships of the siege. After the garrison had been reduced to the necessity of subsisting on food loathsome to humanity, Kirke made a second attempt for its relief. A frigate and two provision ships sailed up the river, broke the boom thrown across it to obstruct their passage, and entered the town uninjured. The Irish army, whose hopes of success had rested wholly on the effects of famine, raised the siege in despair. The town's people, though reduced to half their original number by the casualties of war and sickness, had the hardihood to issue out in pursuit of the retiring army; but their temerity was punished by a severe check. About the same time the Enniskilleners gained a signal victory at Newtown-Butler, over a body of the enemy three times their number.

The military career of James in Ireland was neither creditable nor fortunate; his political efforts during the short period of his Irish government remain to be canvassed. A parliament was assembled in Dublin, in which the Protestant party, as might have been expected, was considerably outnumbered by the Catholics. One of its first acts was the attainder of about two thousand Protestant noblemen and gentlemen, adherents of William, whose estates were to be forfeited, unless they surrendered before a certain day, and who, if found guilty, were to be excluded from the benefit of a royal pardon; an act almost equalling in the extent of its powers, and the severity of its inflictions, the rigours of the act of settlement. The other measures of this parliament were of a different character; one was an act for establishing liberty of conscience, and repealing all such as were contrary thereto; another, connected with religious observances, directed that all should pay their tithes to the pastor of their own persuasion. A bill was also brought in to repeal the act of settlement, which was carried after much opposition from the Protestant bishops, and some of the lords. Another to prevent appeals to England was also carried, though with much difficulty. Two more, the one to repeal Poyning's law, the other to establish inns of court in Dublin, were opposed by James himself, who, still fondly clinging to the hope of a restoration to his seat of dominion in England, was averse to whatever had a tendency to diminish the dependency of Ireland. His conduct with respect to the circulating medium is the most unjust, as well as the most impolitic, of his measures. Parliament had voted him a subsidy of twenty thousand pounds a month. He doubled this sum by a royal ordinance. The money, notwithstanding votes of parliament and kingly proclamations, came in slowly. James erected a mint in Dublin, where he had large quantities of base metal coined into pieces of large nominal value. The plan, as a financial project, proved a complete failure, bringing discredit on the deviser, and inflicting injury on the friends of his cause, who were the ultimate sufferers by the depreciation.

Whilst James was neglecting his military operations in the north of Ireland, and injuring his credit and resources by his financial mismanagement in Dublin, his antagonist William, now freed by the death of Dundee from the apprehension of a Scotch invasion, was making extensive preparations for carrying on the war in Ireland. In the summer of 1689, his favourite general Schomberg landed near Carrickfergus, with a well-appointed army of ten thousand veterans. After taking that town, which surrendered on honourable terms, he moved southwards to Dundalk, where the scarcity of provisions, and the approach of the Irish army under James, obliged him to halt and encamp. His position was low and unhealthy, his camp ill supplied with provisions. His men sunk rapidly, through sickness and inaction. James, though much urged to it by his officers, could not be prevailed upon to hazard an assault. After remaining some time opposed to each other in a state of inaction, Schomberg took advantage of the arrival of some fresh troops to change his position, and retrace his steps towards Carrickfergus, where he was more secure against the necessity of combating to disadvantage with a superior force.

Next year William resolved to take the field in person. He landed early in June at Carrickfergus, and being joined by Schomberg with the remains of his shattered forces, advanced southwards in the same direction that had formed the line of march in the last campaign. His forces now amounted to six and thirty thousand men, the greater part veterans, who had proved themselves on the Continent. James's army had been in the mean time furnished with a supply of five thousand Frenchmen; but these were raw and undisciplined, and procured by an exchange of an equal number of Irish, the flower of his army. After retreating before his rival from Dundalk to Drogheda, he at length took up a position on the south side of the Boyne, where, contrary to the advice of all his officers, he determined to make a stand, and to set his chance of dominion on the hazard of a battle. William, whose disposition and circumstances equally urged him to bring the contest to an immediate decision without hesitation, prepared to force the passage of the river. Whilst engaged in reconnoitring the enemy's arrangements, he received a wound on the shoulder from a piece of artillery levelled at him from the opposite bank, but not sufficient to prevent him from appearing at the head of his troops in the ensuing day's engagement. The next morning his army, headed by himself, moved to the attack in three divisions. Crossing the river where the water in some places came up to their breasts, his troops gained the opposite bank, notwithstanding a galling fire from the infantry, by which they were lined, and repeated charges of the Irish cavalry led on by General Hamilton. Schomberg was killed, as is supposed by a chance shot from his own soldiers, in the confusion of one of these desperate assaults. Callimote, the leader of the French Protestants in William's army, also fell during the passage. Walker, likewise, the clerical defender of Derry, fell here. When his death was reported to William, the only remark made by the cold Dutchman was, "The fool; what business had he there?" The Irish, after some vain efforts to drive back the enemy into the river, in one of which Hamilton was taken prisoner, finally broke and quitted the field, thinking only of making good their retreat.

Whilst William was thus actively engaged in asserting his title to his newly-acquired throne, James was standing aloof on the hill of Donore, an idle spectator of a struggle which involved the fortunes of himself and all his adherents. On seeing the discomfiture of his army, he immediately fled to Dublin, and thence to Waterford, leaving directions to have the bridges broken down after him, to check his pursuers. William, adopting the same system towards him as when he had driven him from England, allowed him to continue his flight unmolested. Proceeding to Drogheda, he forced it to surrender on a threat of military execution in case of resistance, and thence continued his march without interruption to Dublin, holding out offers of protection to the peasantry, who accepted his protection, but declaring that he would leave the leaders, of what he chose to call a rebellion, to the chances of war. The main body of the Irish army retreated to Limerick and Athlone, placing the strong line of the Shannon between themselves and their victorious enemy. An attempt made upon Athlone by General Douglas was unsuccessful. After being baffled in an attempt to force a passage there, and in another at Lanesborough, lower down the river, he was forced to desist and retire to Dublin. A similar attempt made by William upon Limerick met with the same termination. Relying for success on the dissensions that existed between the French and Irish officers in James's army, he advanced to that town, carrying with him only a field train of artillery. On being apprized of his error by the formidable aspect of defence presented by the garrison, he sent for his battering train from Dublin, which, when within seven miles of his camp, was attacked and totally destroyed by a sortie of General Sarsfield. William, however, was not of a temper to be easily discouraged. With two pieces which had escaped the fate of the others he effected a breach, and proceeded to attempt an entrance by storm; but the breach was defended so gallantly that he was forced to retreat and raise the siege, after having suffered a loss of two thousand of his best men. The urgency of his affairs in England obliged him to go thither, leaving the command of the army to his generals, Solmes and Ginckel. The war was carried on during the winter, chiefly from a suggestion of the Earl, afterwards the celebrated Duke, of Marlborough, who proposed the taking of Cork and Kinsale, so as to secure the command of the southern coast. The suggestion was adopted, and its execution intrusted to the proposer of it. The fortifications of Cork were in a state of great dilapidation; the place was in a hollow, commanded by the surrounding mountains. After a short resistance, the only remarkable feature of which was the death of the Duke of Grafton, one of the natural sons of Charles II., the town surrendered on condition of protection to persons and property. But it was with much difficulty that the commanding officers enforced the observance of these terms. As soon as the troops had entered, a tumult was excited, the governor was wounded, the Earls of Tyrone and Clancarty narrowly escaped, and the houses of many Catholics were plundered. Kinsale, which was afterwards invested, presented more difficulty. The garrison abandoned the town, and confined their defences to two castles. One of these, the old castle, was soon stormed; but the other held out until its garrison procured permission to march out with their arms and join the main body of the Irish. Ginckel, after the capture of these places, attempted to carry the war into the west of Cork and Kerry; but his troops were foiled in the mountain passes, and forced to return with loss. Whilst the military operations were proceeding thus languidly, the civil officers of King William were more active and successful in securing their own interests, by the confiscation of the property of the adherents of King James. The forfeitures made by them comprehended a million of acres, the property of three thousand nine hundred and twenty-one sufferers, and were valued at three millions three hundred and twenty thousand pounds. The injustice of inflicting such a penalty on adherence to the cause of a rightful sovereign can only be surpassed by the means of its enforcement. The Irish gentry who possessed estates were indicted for high treason in their respective counties, and the causes then removed by *certiorari* into the King's Bench in Dublin. Thus, in most cases, the accused persons were deprived of the means of making their defence. In many, they were ignorant even of their accusation, until they found themselves stripped of their patrimony by the sentence of the court. At the same time rumours of plots and conspiracies were set afloat, and proclamations issued in consequence, assessing the Catholic inhabitants of peaceable counties for injuries to Protestant property in others, excluding from protection those who had sons in the enemy's quarters, prohibiting assemblages of more than ten Catholics, and subjecting to transportation the

History. parish priest of places where such assemblages were held. These proceedings drove the great body of the Catholics to desperation. They saw no hope but in the subversion of a government whose establishment was to be secured only by their utter ruin.

Military operations recommenced vigorously at the beginning of summer. St Ruth, who had been sent from France to take the chief command, determined to make a stand at Athlone, which he strengthened with some works. Ginekel directed his main force against it. His first assault failed. After a delay of nine days spent in preparations, a second attempt was made with still less effect. Not only were his troops repulsed, but his works were burned. St Ruth, intoxicated with his success, withdrew the greater part of his men from the defences, in spite of the warnings of his Irish officers. Ginekel, aware of the inconsiderate movement, took advantage of it, and forced the passage of the Shannon by surprise, whilst St Ruth was celebrating his victory by balls and entertainments in his camp at some distance. The Irish general then retired to Aghrim, on the borders of Galway, there determined to make a final stand, on a position chosen by himself. He was soon followed thither by the English, who attacked the position with undaunted intrepidity. For some time the contest was doubtful; but the death of St Ruth, who fell by a cannon-ball in the heat of the action, decided its fate. Whether from jealousy or contempt, this foreigner had avoided communicating his plans to the Irish generals who were to execute them. His sudden death, therefore, left the army without a head. All was confusion; and Ginekel, taking advantage of this state of things, pressed on and obtained an easy, but not a cheap victory. In the preceding struggle, upwards of two thousand of his men had fallen. The loss of the Irish, which occurred mostly in the rout, exceeded seven thousand.

The remains of the Irish army fell back upon Limerick. This city was now the only place of any importance that held out. Galway had surrendered upon favourable conditions. The garrison of Banagher, on declaring their determination to return home after surrendering, were supplied by their conqueror with the means of proceeding thither. Ginekel, who had remained some time inactive in Galway, hoping that terms of accommodation would be offered, as Tyrconnel was now dead of an illness said to be caused by disappointment, and the lords-justices who succeeded him were inclined to make terms, provided the interests of the general body of the Catholics were secured by them, at length opened the trenches before Limerick. At first the operations of the besiegers proceeded but slowly. Having, however, made themselves masters of a pass across the Shannon, through the treachery of Colonel Clifford, the officer who commanded there, they were enabled to invest the town on all sides. This advantage was followed by an assault on one of the gates, which was urged with so much ardour, that the officer there thought it necessary to raise the drawbridge with so much precipitation that upwards of a thousand of the garrison were left on the outside, exposed to the besiegers' fire. The greater part of these unfortunate victims were killed either by the enemy or in attempting to swim the river; a few were captured. The act itself was condemned as over hasty. The officer who gave the order for it was a Frenchman, and his conduct was imputed to bad motives. The bad feeling that had long subsisted between the strangers and the native troops was thus greatly exasperated. The latter, conceiving that their countrymen had been wantonly sacrificed, determined to seek for peace. Their resolution was encouraged by Ginekel, and a cessation of arms for the purpose of adjusting the terms of a treaty was the consequence. The news was immediately forwarded to the lords-justices in Dublin, just in time to prevent the publication of a proclamation, offering to the Irish in arms terms as liberal as they could have hoped for after a victory; granting, in fact, to the Catholics all the privileges they had heretofore enjoyed, and all they have since obtained. The lords-justices hastened to the camp, and in two days after their arrival the articles of Limerick received the signatures of both the contracting parties.

By this treaty it was stipulated that the Roman Catholics should enjoy the exercise of their religion, as during the reign of Charles II.; to which was added a promise that the king would endeavour to procure further security for them on this point, as soon as parliament should be assembled. It was further agreed, that all the inhabitants of Limerick, and those in arms for King James in the counties of Limerick, Clare, Kerry, Cork, and Mayo, should enjoy their estates, and be suffered to pursue their respective avocations unmolested; that the Catholic gentry should be allowed the use of arms, and should not be called upon to take any oath but that of allegiance; and, finally, that all the soldiers who were unwilling to submit to these conditions should be conveyed to the Continent at the expense of the English government. Two days after the signing of this treaty, a French fleet arrived on the coast with a large supply of reinforcements and military stores. But it was then too late. Nothing now remained in order to terminate the war, but the execution of that part of the treaty which permitted the Irish soldiery to choose between residence at home and service under a foreign but friendly power on the Continent. The Irish guards set the example; they all volunteered for the service of the king of France, seven individuals only excepted. Two regiments of Ulster Irish returned home in a body. Of the remainder of the Irish army, but one thousand horse and fifteen hundred foot remained. The generous self-devotion of those who sacrificed their country for their principles was but ill rewarded. On the arrival of the troops in France no quarters were assigned to them. The regiments were broken up, the officers reduced to lower grades, and the generals excluded from court. After some time, however, the value of their services was acknowledged, and the Irish brigade, during the succeeding continental wars, long maintained the highest character for fidelity to the cause it had embraced, and for the intrepidity it manifested under every circumstance of difficulty and danger.

A parliament was convened shortly after the ratification of the treaty. It was the first that had assembled after a lapse of twenty-six years of intestine commotion. Composed as it was of a great majority of Protestants, it testified little inclination to co-operate with the king's wishes, in adhering to the strict fulfilment of the articles of Limerick. The king evidently wished them to be maintained in the spirit as well as in the letter. The feelings of the leading party in parliament were sufficiently indicated in a sermon preached by the Bishop of Meath before the lords-justices, which inculcated the detestable doctrine that Protestants were not bound to keep peace with Papists. The first open breach that occurred between the government and the House of Commons was caused by the introduction of two money bills. According to the system of Ireland under Poyning's law, no bill could be brought into parliament until it had received the approbation of the king through the privy council. According to the principles of the British constitution, all money bills should originate with the House of Commons. The party opposed to the king took their stand upon the latter ground. One of the two bills was rejected altogether, and the other suffered to pass solely in consideration of the present exigency of affairs, and the pressing necessity of raising a supply for the king's service. Lord Sidney, in retaliation, suddenly prorogued the parliament, after reprehending the House of Commons sharply for what he styled an undutiful and ungrateful invasion of the royal prerogative. This act increased the general discontent, as several measures of importance then in progress were left unfinished.

A new parliament, assembled in 1695 by the Lord-deputy Capel, opened with an assurance from the throne, that the king was intent upon the firm settlement of Ireland upon a Protestant interest. Such a declaration was hailed with joy by the prevailing party. In order to support the king in this measure, a committee was appointed to consider what penal laws were in force. The following were found to be the principal: 1. An act subjecting all who maintained the supremacy of the church of Rome to the penalties of a *præmunire*, and requiring the oath of supremacy as a qualification for every office. 2. An act imposing fines on absence from the parish churches on Sunday. 3. An act authorizing the chancellor to appoint a guardian to the child of a Catholic. 4. An act to prevent Catholics from being private tutors, without license from the bishop. Having ascertained the actual state of restrictions on the Catholics, as they had existed previously to the treaty of Limerick, the parliament proceeded, not to secure them in the privileges guaranteed to them by that instrument, but to increase the number of penalties and restrictions, contrary to its spirit and tenor. The following statutes, passed by this parliament, formed the commencement of the system of restrictive legislation now known by the name of the penal code, which, when wound up to its acmé of intolerant severity, by the successive enactment of laws, each surpassing its predecessor in severity, was described by Burke as the acmé of refinement in political persecution. These acts were, 1. to deprive Catholics of the means of educating their children, either at home or abroad, except under Protestant teachers, and to prevent them from being guardians even to their own children; 2. to disarm the Catholics; 3. to banish Catholic priests and prelates. Having passed these acts in direct violation of the treaty, they proceeded to confirm those articles, or so much of them as might consist with the safety and welfare of the king's subjects in these kingdoms. The bill took care that the precautionary proviso should not be a dead letter. It abrogated the articles which provided for the security of the Catholics from disturbance on account of their religion, which confirmed them in the possession of their estates and the exercise of their profession, which allowed them the use of arms, and which required the oath of allegiance only as a test of their loyalty. The bill passed the House of Commons with little difficulty. But in the House of Lords, where several of the Catholic peers still had seats, it was strenuously resisted; and when carried, a protest against it was entered on the journals by thirteen peers, six of whom were bishops. This mutilated ratification of the treaty was followed up by three other penal laws: 1. To prevent the intermarriages of Protestants and Catholics; 2. to prevent Papists from being solicitors; and, 3. to prevent them from being gamekeepers.

The spirit of religious intolerance that gave birth to these acts was not the only evil that checked the prosperity of the country. The commercial spirit of monopoly of the English manufacturers, who had long viewed with a jealous eye the increase of the woollen manufacture in Ireland, to which the cheapness of living and the excellency of the pasturages afforded peculiar advantages, prevailed on the king to make a solemn assurance that he would do all that in him lay to discourage that manufacture, adding as a mitigation of a declaration so iniquitous, that every encouragement should be afforded to the linen manufacture. The former part of the promise was rigidly adhered to, the latter was disregarded. Every attempt to establish the linen manufacture in the south of Ireland failed, chiefly from the opposition given by the clergy to the introduction of an equitable modus for the tithe of flax.

Whilst parliament was thus employed during the reign of William, in undoing the bonds of the treaty of Limerick, the court of claims appointed to investigate and dispose of the lands forfeited by the adherents of James was equally active in its invasion of their property. Amongst the chief sufferers by the decisions of this court was the Earl of Clancarty. It appeared doubtful whether his noble estate should be included amongst the forfeitures. The point was decided by a declaration of the grand jury of the county of Cork, which resolved that its restoration would be prejudicial to the Protestant interest. It was therefore sold, under a decree of the court. A subsequent attempt made in his favour in the reign of George II. was not only equally unsuccessful, but all attempts at a repetition of it were crushed by a vote of the House of Commons, that any lawyer who pleaded in his behalf should be deemed an enemy to his country.

The annals of Ireland during the reign of Queen Anne are merely a record of the exertions of the Irish parliament to rivet and extend the penal laws. By an act passed in 1703, the father of a Papist who conformed to the established religion was incapacitated from disposing of his property by sale, mortgage, or bequest; and a Papist was prohibited from being guardian to his own child, who, on conforming, was to be taken from his parent, and given in charge to a Protestant. Papists were rendered incapable of holding lands for more than thirty-one years; and if the profit rent of such land was found to exceed one third of the actual rent, the benefit of the lease was to be transferred to the Protestant who made the discovery. They were also prevented from inheriting the lands of their Protestant relatives, and their own lands were to be gavelled after death amongst their children. The most extraordinary provision of this monstrous act, was the requiring the oath of abjuration, and the sacramental test, to be taken as a qualification for office and for voting at elections. The cause of its insertion is singular. The English government was at this time negotiating with the emperor of Germany for the toleration of Protestantism throughout his dominions. To press the enactment of severe laws against the Catholics at home at such a period, exhibited an inconsistency as absurd as it was iniquitous. An effort was therefore made to dissuade the Irish parliament from proceeding with the bill, but to no purpose. Knowing, therefore, that the majority of the lower house consisted of Protestant dissenters, the clause requiring the taking of the sacramental test was inserted by the English council, in the hope that the rigid puritans would reject the whole bill rather than saddle themselves with the disqualification. But they were mistaken. Bigotry prevailed over self-interest; and the puritans of the day acquiesced in the passing of a law, which deprived the conscientious members of their own persuasion of the right of exercising the most valuable privileges of freemen, rather than suffer their Catholic countrymen to participate in them.

This act was followed up by resolutions calling upon all the civil officers of the government to enforce its provisions, and declaring that the prosecuting and informing against Papists was an honourable service to the government. But this law, and these resolutions, were not deemed sufficient. In 1709 another act was passed, imposing additional restrictions upon the Catholics, by which they were prohibited from holding annuities for life; requiring the father of a conforming child to give in to the chancellor a strict account of the value of his property, in order to apportion a due share thereof to his support. Jointures were secured to conforming wives. Papists were forbidden to be assistants in schools. Popish priests who conformed were allowed a stipend of L.30 a year, that of a Protestant curate being L.50; and rewards were offered for the discovery of popish prelates, priests, and teachers, at the rate of L.50 each for the first of these classes, L.20 for the second, and L.10 for the third. A subsequent statute excluded Catholics from acting as sheriffs, and from sitting on grand juries, and even proceeded as far as to enact, that in trials arising out of statutes for strengthening the Protestant interest, the plaintiff might set aside a juror on the ground of his being a Papist. The example of the parliament was followed by the corporations. Bye-laws were enacted, excluding Catholics from every profitable branch of trade. The result was, that all the Catholic gentry possessed of the means of emigration quitted the country, as did all the merchants of respectability, carrying with them, to fructify in other and in hostile countries, the property which might have enriched that of their persecutors.

The system was now nearly complete. The Catholics were excluded from every opening to political power. They were not exterminated, because the land would have been valueless to the new proprietors, without the assistance of labourers sufficient to extract its produce. The effects of the system soon began to appear. The son of James II. made an attempt to recover his father's dominions in the beginning of the reign of George I. The new proprietary took the alarm. On the first rumour of his intended project against Scotland, a number of Irish Catholic gentlemen were thrown into close confinement. The government, however, ashamed of this unnecessary ebullition of terror, soon afterwards caused them to be liberated, even without payment of the customary fees. The alarm was futile. The Irish had not the means, nor even the inclination, to renew the contest. Their spirit was broken by the grinding degradation of the restrictions thrown around them. Yet, to make assurance still surer, these restrictions were increased by the addition of new clauses to the penal code, mostly of minor importance, by one of which Papists were excluded from voting in vestries for the assessment of money for repairing or rebuilding parish churches.

The Irish Protestants were equally active in asserting their own liberties, as in extinguishing those of the Catholics. An attempt made by the English House of Lords to exercise the right of ultimate jurisdiction in cases of disputed property, to the prejudice of the peers of Ireland, was stubbornly resisted; and though the dispute was cut short for the time by an English act, declaring that the British parliament had full power and authority to make laws to bind the people of Ireland, the acquiescence of the latter proceeded, as future events fully proved it, from a consciousness, not of the defect of right, but of power to assert it. In its resistance to another act of British interference the country was more successful. The coinage, particularly of copper, was deplorably defective both in quantity and in value. An application for a domestic mint, a right often before allowed and exercised, was rejected, and in lieu of it a patent was granted to an English brassfounder of the name of Wood to coin copper to a large amount. The pride of the Irish took fire, and the circumstances of the case elevated the feeling into patriotism. Amongst the opponents of Wood's patent, Jonathan Swift, the celebrated dean of St Patrick's, was most eminent. In a series of letters, published under the name of the "Drapier," he denounced the scheme as illegal and ruinous. One of the letters was deemed libellous, and a large reward was offered for the discovery of the author. But the fidelity of the dean's partisans bore him harmless; the storm passed over without injury to him. The invidious patent was recalled; and his grateful country has embalmed his memory in the immortality of patriotism.

The state of the Catholics was now brought down nearly to the lowest point of depression. An address of congratulation to George II. on his accession, presented to the lord-lieutenant by Lord Delvin, on their part, was suffered to remain unnoticed, except so far as to render so faint an effort an apology for still further restraints. A bill was brought in for excluding Papists from voting at elections. By another, lawyers and attorneys married to Papists were prevented from practising. Even converts could not hold the office of justice of the peace if their wives and children continued to be recusant; and persons plundered by privateers in the service of a popish nation were to be reimbursed by a levy on the goods of Roman Catholics only. A vote of the Commons, declaring any person who took legal steps for the recovery of his tithes of dry cattle, commonly called the tithe of agistment, to be an enemy to the country, threw the greater part of the burden of maintaining the Protestant clergy from the rich proprietor, whose land was wholly under pasturage, upon the Roman Catholic cotter, who was obliged to raise some grain on his little patch of ground for the subsistence of his family.

Whilst the Irish parliament were thus vigilant in cutting off from the Catholics all means of regaining political power, they were no less so in preventing any encroachment of the English government upon the rights they themselves possessed. The relations of these two latter parties towards each other after the Revolution were peculiar. The members of the House of Commons held their seats, not, as in Great Britain, by septennial election, but during the pleasure of the crown. Their tenure was therefore generally regarded as tantamount to a life estate, subject only to a dissolution on the demise of the crown. Hence they were virtually unrestrained by popular control. On the other hand, as the lord-lieutenant came over to Ireland but once in two years, to hold a parliament for granting the supplies, the management of the country rested with the lords-justices nominated to hold the reins of government in his absence, who were selected from among the most powerful of the great Protestant families. Their influence, in questions between the two countries, was therefore often directed to thwart the measures of the English cabinet, particularly when these seemed to interfere with their own aggrandizement. The operation of the penal laws, whilst it enslaved the Catholics, pauperized the country. The great mass of the population was deprived by them of the main stimulus to industry, the hope of improving their condition by their own exertions. The great proprietors found their land becoming of less value, from the neglect of agricultural improvement. The supplies for the service of government were therefore granted with a niggardly and reluctant spirit. The English cabinet hoped to cut the knot that thus linked them to the Irish parliament. An attempt was made to obtain a vote for the supplies for twenty-one years. The Irish aristocracy immediately took the alarm. However acquiescent in the general tenor of their votes, they now rallied, and the insidious attempt was rendered abortive by a majority of one.

The depression of the country, arising from the treatment of the Catholic part of the population, was endeavoured to be remedied by the extension of education, the formation of patriotic societies, and the execution of public works. To educate the Catholics, it was necessary they should first be converted, because by the penal code domestic education according to the principles of their own faith was prohibited. Schools were therefore opened, in which the pupils were taught the elements of literature and the useful arts, and were also clothed and fed at the public expense. Being established by letters patent from the crown, these obtained the name of charter schools.

Their professed object was the diffusion of useful knowledge; but as their primary process was based upon Protestant instruction, and as this, to be effective, required a total severance of the parental tie which linked the Catholic peasant to his family, the effort failed. The second element of national regeneration was attempted by the formation of a society, in imitation of the Royal Society of London, under the name of the Physico-Historical Society, for the improvement of agriculture, husbandry, and the useful arts, which afterwards merged into the Royal Dublin Society. The last-named element of improvement, the execution of public works, gave rise to the measure of inland navigation. But none of these were effective to the extent proposed by those who set them on foot. The great object was not merely to give Protestantism the ascendency, but to eradicate Catholicism; to realize, in fact, what was imagined by a fiction of law, when, in a case where a Catholic came into a court of justice, he was gravely told that the law did not recognise the existence of a Papist. Education, whether of the primary rudiments or of the higher departments of science, gave knowledge, and knowledge revealed the extent and gloom of degradation. Useful works required workmen, and thus circulated capital amongst the Catholic population, to which the undertakers were compelled to have recourse for the mechanical parts of such undertakings. A state of society so anomalous, in which universal liberty was the avowed principle, yet slavery, unmitigated by the protection which sordid interest extends to the preservation of individual property, was the practice, could not but be most precarious. The ruling party, aware of the danger of explosion, at length found itself compelled to give vent to the under-workings of the re-action against oppression, by a partial change of system. That of ever-increasing compression, painful and hazardous at all times, was found, in periods of general agitation or impending warfare, impracticable. The threatened invasion of England by the young Pretender was the crisis which led to a change of domestic policy towards the Catholics. Ireland, as the weakest point of the empire, was looked upon as the most exposed. The Irish population was numerous and discontented. Their deficiency in the means and the organization of war could be instantaneously supplied by the wealth of France, and by the long-proved skill and valour of their countrymen, the Irish brigades in the French service. To ward off the apprehended danger, Lord Chesterfield was sent over in the spirit of conciliation. To the Catholics, worn down by the action of half a century of increasing oppression, the slightest relaxation of the highly strained engine of oppression became comparatively a blessing. An accidental circumstance afforded the new governor an opportunity to evince the sincerity of his professions. Hitherto the Catholics had held their assemblages for religious worship in the most secluded and secret places. The rewards offered by the laws for the detection of their priests, or of those who attended their ceremonies, compelled them to the strictest secrecy. The floor of a building in one of the confined streets of Dublin, where mass was celebrated, gave way, and caused the death or mutilation of a number of the wretched beings, congregated to worship their God at all hazards, in the way in which they had been trained. Lord Chesterfield, with the tact which has immortalized him as a first-rate character in the annals of fashionable life, seized the opportunity of declaring openly that he would not be a party to a system of religious prevention, liable to the hazard of such results; and the meetings of Catholics for the purpose of religious worship were consequently winked at. Still, however, the spirit of the penal code remained unrestricted; and operative laws were passed during the government of this, the first of the tolerating lord-lieutenants, not only annulling all marriages between Protestants and Catholics, if celebrated by a Catholic priest, but also rendering the clergyman who performed the ceremony liable to capital punishment. The threatened storm from abroad blew over. The invasion of the young Pretender forms no part of Irish history. The Irish Catholic remained unmoved in his habits of passive obedience. The Irish Protestant returned to his parliamentary controversies with the ruling powers in England. Where there existed such a consciousness of overwhelming superiority on the one side, acting upon a spirit of domineering independence, checked by an internal conviction of weakness, the weakness of division, on the other, collisions between the English cabinet and the Irish ascendency party could not fail to be frequent and acrimonious; much less could such collisions fail to throw to the surface some of those restless spirits which political convulsions have shaken from their orbits of ordinary movement. A contest between the Irish privy council, which then exercised the most important parts of the legislative functions of government, and the corporation, stimulated Charles Lucas, a Dublin apothecary, to assert the rights of the latter. Though unsuccessful, he was not unrewarded. The death of the two representatives for Dublin gave rise to a contested election, an event of rare occurrence under the then existing constitution of the Irish parliament. Lucas was elected, under the pledge of vindicating, in the House of Commons, the perfect independence of the Irish legislature. This doctrine, first broached by Molyneaux shortly after the Revolution, in a treatise called the "Case of Ireland," was viewed with alarm by the English party in the house, and with jealousy by that of the Irish aristocracy. By the one it was viewed as a severance of the connection of sovereignty and dependence between the two countries, by the other it was felt to sap the foundations of their own domestic omnipotence. Passages of libellous tendency were extracted from Lucas's publications. The House of Commons declared him an enemy to the country, and passed a vote for his prosecution. He evaded the coming storm only by retiring to the Continent. On a subsequent vacancy, however, he was re-elected, and took his seat as one of the representatives of the people, which he retained till his death. The Irish parliament, arrogant where it felt secure in its own power, was tamely submissive under circumstances wherein an assertion of its just rights would have been truly creditable. A surplus revenue remained in the Irish exchequer. The English council insisted on the king's right to dispose of it at pleasure. The Irish Commons equally insisted on their absolute control over the public purse, without any interference from other quarters. The bill acknowledging the necessity of the royal consent to the appropriation of the surplus income was rejected by the Commons. The English council cut the matter short. The money in dispute was drawn out of the treasury by a king's letter, and the Commons passively acquiesced in the spoliation and insult.

In this state of torpid tranquillity, ruffled only by apprehensions of internal commotion, or by the agitation of partisan quarrels between the rival factions of court and country which divided the dominant party, Ireland continued to advance for nearly seventy years after the Revolution, until at length the elements of activity were roused by the reality of an actual invasion. In the year 1759, a fleet was fitted out in the French ports, for the avowed purpose of landing a large armament in Ireland. A small squadron under M. Thurot, supposed to be an advanced section of the main fleet, and intended to cause a diversion of the defending forces, landed in the north of Ireland, and took possession of the town and castle of Carrickfergus, with little opposition. After holding it a few days, the French commander, checked by the appearance of the general and determined resistance which was gathering around him through all the northern counties, deemed it expedient, instead of proceeding to the assault of the wealthy and undefended town of Belfast, which lay at but a few miles' distance, to re-embark. Any further repetition of his predatory incursions was prevented by the destruction of his little armament in the channel, in an engagement, in which Thurot himself lost his life.

The alarm excited by the threatened invasion afforded an opportunity to the Catholics to call the attention of the government to their sufferings. An address, framed by a committee of their body, was presented to the lord-lieutenant, making a tender of their allegiance at this critical period. Its favourable reception brought forward others of the same kind from every part of the country, and thus was the first impulse given to the movement for the repeal of the penal code. Another opportunity of echoing the sentiments contained in these addresses presented itself on the accession of the new king, George III. It was eagerly seized on, and the address was received with equal favour as the former. The state of the country required some vital change in its internal administration. The revenue was declining, and the peasantry were every year becoming more destitute and discontented. The wretched sufferers, attributing their misery to the exaction of tithes and the enclosure of lands hitherto left open in commonage, banded themselves together in large bodies at night, and destroyed the new enclosures; whence they at first received the name of Levellers, but were afterwards better known by that of Whiteboys, from their wearing white shirts over their clothes, to be known to one another in their nocturnal expeditions. From the invasion of property they proceeded to the attack of persons obnoxious to them, particularly tithe proctors, treating with wanton and barbarous cruelty those who fell into their hands. The government, instead of probing the evil to the bottom in order to effect a cure by the removal of the cause of irritation, retaliated by a series of severe and arbitrary laws, known by the name of the Whiteboy Acts, many of which are still in force. Attempts were made to connect those insurrections of desperate misery with the political movements of France. Rumours were circulated that the Whiteboys were encouraged by money from that court, and that their combination was the explosion of a plan for restoring the Pretender. A parish priest of the name of Sheehy, who had made himself obnoxious to the gentry in his neighbourhood by his exertions to shield the peasantry from their oppressions, was arrested on a charge of treason; and, though acquitted of that crime after a patient and long investigation by a jury in Dublin, he was, on his return home, again arraigned on a charge of murder, universally known to be false, and executed. The situation of the British government in Ireland at this time was extremely irksome and invidious. In order to carry on the public business smoothly, it became necessary to conciliate the great landed proprietors, who, through their borough influence, had the control of the House of Commons. They were to be gained over partly by allowing them a large share in the disposal of all places of trust and profit, and partly by indulging their enmity to the Catholics, who were still suspected of being cemented in a secret union for the recovery of their forfeited estates. The party which thus virtually ruled the country by playing the British government and the Irish people against one another, was known by the name of the Undertakers. They had a double object; the one to make the crown, as far as Ireland was concerned, dependent on themselves; and the other to check the spirit of liberty in the people, and at the same time to throw on the government the odium of the measures of which they themselves were the instigators. To break down this petty aristocracy, which had intruded itself between the prerogative of the crown and the rights of the people, the British cabinet resolved, in the early part of George III.'s reign, that the lord-lieutenant, who had hitherto visited the country only once in two years for the purpose of holding a parliament and passing the supplies, leaving the management of the country during the intervening period to two or three lords-justices chosen from among the leaders of the Undertakers, should reside permanently in Dublin, so as thus to be the immediate and ostensible organ of government patronage and influence. At the same time, to put a stop to the outcry against the mismanagement of the public income, which was attributed to the people's want of a sufficient check over their representatives, the duration of parliaments, which hitherto had terminated only on the demise of the crown, was limited to eight years, so that, as the parliaments then sat only ever second year, there should be four sessions between each dissolution. Lord Townshend, a nobleman of moderate political, but of great convivial endowments, was selected as the most fitting person to effect the change. He succeeded with much difficulty, some loss of character, and great expenditure of the public money. But the people felt no benefit from the change. The places and pensions, hitherto bestowed on the dependents of the Undertakers, were now lavished with augmented profusion on the creatures of the lord-lieutenant. The disappointed borough holders of the old parliaments felt their power in the House of Commons increased by the curtailing of the period of legislation. They threw themselves into the ranks of opposition, to thwart the measures of the government which they could no longer direct. The parliament was the arena for the struggle between the two parties, and the real interests of the country were disregarded. The severity of the Whiteboy Acts caused a temporary cessation of insubordination in one part of the country, only to give vent to it in another. The disturbances in the south had been imputed to Catholic conspiracy, aided by foreign influence. A similar systematized spirit of outrage now displayed itself in Ulster, which was chiefly inhabited by a Protestant population, that had already testified its loyalty during Thurot's invasion. The real cause of disaffection was the same in both parts of the country. High rents, and the rapacity of the agents of absentees, drove the people into insurrection. The assembled multitudes here took the name of Hearts of Steel. For their suppression, the legislature passed an act that offenders should be tried in counties different from that in which the crime was committed. The extreme severity and injustice of the law counteracted its operation. Dublin juries, disgusted at a measure so arbitrary and unconstitutional, acquitted the prisoners, and the law was soon repealed. Emigration to the American colonies was the consequence of the depressed state of the peasantry, and of the severity with which they were treated. The war with those colonies, by closing this vent for the discharge of the popular discontents, caused them to accumulate at home. It also increased their amount by the addition of other grievances arising out of the change from peace to war. America had been the great mart for Irish linens, now the only thriving branch of the national manufactures; it was also the great market for Irish provisions. The war closed the trade, and an embargo laid on provisions in favour of some great English contractors put a stop to their export. The country was also deprived of its portion of the regular troops, which the increasing emergency of the struggle with the revolted provinces called away. The sufferings of the people were intense; and the alarm of danger was shortly afterwards increased by the well-founded apprehension of an invasion from France, now the avowed ally of the Americans. To allay the spirit of discontent which was rapidly pervading all ranks, two measures were proposed, the one in England, the removal of the restrictions imposed there, as unwisely as selfishly, on Irish commerce; the other the relaxation of the penal code in Ireland. The commercial jealousy of the mercantile interest in England prevented the former; the latter succeeded so far as to allow Catholics to hold lands by lease for a long term of years. This boon, though it might excite the hope of more extended liberality, could avail little toward relieving the pressure of immediate distress. Want at home, and danger from abroad, stared the country every year more fully in the face. The landed and commercial interests called on the government for protection. The Earl of Buckinghamshire, then lord-lieutenant, a man of moderate abilities, returned for answer that the government had none to give. The people, urged on by the exigency of the crisis, resolved to arm themselves. Volunteer associations were not hitherto wholly unknown in the country. The military spirit of the nation had shown itself on many preceding occasions, in the readiness with which numerous bodies of men, assuming a self-formed and self-taught military organization, united together on occasions of local or temporary danger. The invasion of Thurot gave rise to some in the north, the outrages of the Whiteboys led to others in the southern counties. But such instances were temporary and local. The impulse now given to the public spirit, by the desponding reply of the government to the appeal for protection, was universal and permanent. The organization commenced in Belfast, to which the lord-lieutenant's answer had been more specially directed. The constituted authorities had told them they were not to look to them for protection, but to themselves. They took the hint, and formed several companies of self-armed, self-disciplined, and self-officered soldiers. The surrounding towns followed the example; and the government, acting in the spirit of its own suggestion, supplied these new-raised levies with arms. The flame of military ardour spread with unexpected rapidity through all parts, and the number of well-disciplined corps soon became so great and so formidable as to dispel all thought of invasion on the one side, and all apprehension of it on the other. The same spirit caused a re-action against the monopolizing restrictions of the British legislature. The people of Ireland entered into a very general combination to confine themselves to the use of their own manufactures. The sudden check to industry thus produced in England caused the supporters of the measure to reflect on its inexpediency; and the military display could not fail to attract their respect.

The people of Ireland now began to expect from their volunteer associations what, according to the principles of the constitution, should only be looked for from the legislature. These bodies were not backward in meeting such expectations. Assemblages of volunteer corps in Dublin and elsewhere passed resolutions that the king, lords, and commons of Ireland alone were competent to make laws to bind the people of Ireland. The political feeling thus excited increased the number of military associations; and, whilst in the parliament the old system of corrupt influence carried all before it by numerical majorities, the volunteers of Ulster, in the consciousness of their strength, held a meeting at Dungannon, declarative of the necessity of a thorough reform of the state of the representation, and of a combined exertion of the whole volunteer force of Ireland to procure it. The effervescence of patriotism was increased by the unsettled state of the administration in England; Lord North had resigned, and the death of Lord Rockingham put a premature end to his short-lived administration. The result as to Ireland was the dissolution of the parliament, against which the feelings of the nation were so highly excited. A new parliament was about to meet; and at the same time a meeting of delegates from all the volunteer corps in Ireland was to assemble in Dublin, to urge on the favourite measure of parliamentary reform.

At this time several individuals had raised themselves to the highest pinnacle in the scale of patriotism. The most remarkable was the Earl of Charlemont, who, after spending his youth amidst the elegancies of Italian refinement, devoted his maturer years to the service of his country at home. Next to him were Grattan and Flood, both members of parliament, both eager to establish the independence of their common country on sure grounds, yet fatally adverse to each other as to the foundation on which it was to be laid; the former considering a simple repeal of all English laws interfering with Irish rights as a sufficient disavowal of the assertion of supremacy, the latter requiring an open and explicit disclamation on the point. Grattan was successful, and the country voted him L.50,000. The breach between the rival patriots was irremediable. Grattan remained at home to continue the struggle for securing the newly-gained rights of his country. Flood soon afterwards retired to England, where a seat in the British legislature flattered him with a more enlarged sphere for the display of his powers. But he failed, and was no longer named as a patriot or statesman.

The meeting of the new parliament and of the volunteer convention took place simultaneously. The first and only act of any consequence adopted by the latter, was a resolution as to the necessity of a reform in parliament; which having been immediately afterwards introduced by Mr Flood into the House of Commons, was there rejected by a large majority; and the convention, partly through an apprehension among many of its members, of dangers from a collision between two representative bodies, both emanating from the same source, and both claiming to be the constitutional organ of their constituents, and partly through a manœuvre of some of its leaders, quietly adjourned, and never afterwards assembled.

Assemblages of large bodies of armed men, unconnected with and beyond the control of the government, could not fail to alarm the ruling powers. The union of these bodies into a deliberative meeting, for the avowed purpose of influencing the legislature, was still more alarming. The first effort of the volunteers to attain this position had been baffled. The meeting of delegates was dissolved; but it might, and there was every reason to suppose that it would, be re-assembled. To prevent such a recurrence by violent means was dangerous. The volunteer body was numerous. It counted upwards of 100,000 men, embracing the greater part of the wealth and respectability of the country, in its ranks; its numbers and discipline were yearly increasing. The consequences of a hostile collision with such a body, particularly at the close of an unsuccessful war, commenced with the avowed determination of crushing the spirit of independence in the American colonies, were fraught with great hazard. An attempt was therefore made to break up the strength of this body by internal divisions. The Catholic question effected this. The volunteers were almost exclusively Protestants. The extension of rights to a portion of the population, so long held in a state of passive degradation, was viewed by many of them with a jealous eye. They looked upon every new concession to the Catholics as so much abstracted from themselves. Still, however, the Catholic cause was gaining ground.

The extension of a free trade to Ireland had afforded the means of accumulating property. It was eagerly seized on by the Catholic merchants and traders. The lately conceded permission to hold land on long leases gave the holder of such property a fixed position and weight in the country. New laws, framed in the spirit of the increasing liberality of the age, extended their rights. They were permitted to purchase, hold, and dispose of land, by will or otherwise, as freely as Protestants. The penal acts prohibiting the celebrating or hearing of mass, keeping horses above the value of five pounds each, instructing their own children, or acting as teachers, were repealed; as were those taxing them for the losses sustained from privateers, obliging them to pay Protestant watchmen, excluding them from residence in particular towns, and some other petty and irritating restrictions. Still they were far from being on a political equality with their Protestant countrymen; and at the very time that the severity of the code was thus relaxed as to property, new laws were passed still further contracting their political rights. By one of these they were debarred from admission into the Inns of Court; by another the English act of William III. excluding them from sitting in parliament, was formally enacted in Ireland. The passing of it attracted but little notice, as the act of William had been hitherto passively acquiesced in by the Catholic body.

Whilst the government was successfully busied in sowing the seeds of disunion amongst the volunteers, it paid little attention to conciliate the people by economy or good management. The reckless system of lavish and profligate expenditure introdueed by Lord Townshend, to break down the monopoly of the Undertakers, was persevered in to secure majorities in the House of Commons. A feeble effort made by the Duke of Buckingham to retrench and restore order into the finances only led to his recall. Yet it was soon found that a government resting on majorities thus purchased depended on a very frail security. The mental derangement of the king in 1789 showed the futility of such reliance. The English cabinet wished to restrict the Prince of Wales in the discharge of the regal powers intrusted to him as regent. The Irish privy council was prepared to follow the example. But the opposition in parliament, anxious to extend their own influence by gaining over the heir-apparent, who had till then always made professions of great liberality of political opinion, resolved to grant him the regency of Ireland, with no restrictions beyond those imposed by the constitution on the sovereign himself. An address to this effect, voted by both houses of parliament, in opposition to the lord-lieutenant, was forwarded to London. The sudden and unexpected recovery of the king prevented its effect. But the British minister, having now so fully before him a warning of the consequences that might result from similar collisions of the two legislatures upon future questions, seemed fully determined to seize on every opportunity of preventing it, by taking measures for effecting a union of the parliaments of both countries, similar to that which took place in Scotland at the commencement of the century. The prevalence of opposition to the wishes of the English cabinet was as transient as it had been sudden. The members who voted against the ministry on the regency question were again found in their places on all ministerial questions, with the exception of those whose rebellion had been too gross and daring to admit of pardon; and the parliamentary management of the country began to subside again into its former state of torpidity.

But the calm was not to be of long duration. A new element of convulsion was at work. The French revolution broke out in the same year in which the king's insanity had caused such excitation. For some time it produced but little effect on the popular movements in Ireland. The Protestants, indeed, began to call more loudly for reform, and the Catholics to press more openly for admittance into the pale of the constitution. Both were disregarded. The government felt itself strong in its majorities, and in the plenitude of its means for securing them. The question of reform was disregarded; that of Catholic relief was not only scouted with marked contumely, but, during the ensuing recess in 1792, every exertion was made on the part of government to draw forth from the grand juries of the several counties the strongest resolutions against any further concessions. Yet the very next year a bill was introduced into parliament by the government, for extending the elective franchise to the Catholics, which was passed by a majority nearly equal to that which had refused to take their claims into consideration in the last session. Bills for amending the representation, and for disqualifying placemen from sitting in the House of Commons, were also introduced. The promises of reform thus held out induced the minority to acquiesce in several coercive measures, particularly one against the holding of conventions by delegation. Enactments of the latter character having been secured, that of reform was allowed to languish, and, next year, was rejected by an overwhelming ministerial majority. The French war in which England was now involved had been the cause of this sudden burst of concession; but when the means of carrying it on, and of checking by severity any efforts to excite discontent at home, had been assured, the mask was thrown off, and the management of affairs carried on with increased profligacy of expenditure, and disregard of public opinion. The advocates of reform, despairing of any change of measures from parliament, endeavoured to carry the question of reform by a pressure from without, through the agency of voluntary associations. They formed a Whig Club, which afterwards was superseded by that of the United Irishmen. One of the leading features of both societies, especially of the latter, was the advocacy of the Catholic question, as it now appeared evident that the question of reform was hopeless, without the previous admission of the Catholic body to their rights of freemen. The government, after some further perseverance in measures of harshness and restraint, heightened by the increased violence of the leaders of the people, the principal of whom, Wolf Tone, Hamilton Rowan, and James Napper Tandy, were forced to expatriate themselves, changed at once to a system of conciliation. In assurance of the sincerity of the change of sentiment, Earl Fitzwilliam, a nobleman possessed of large estates in Ireland, and a steady advocate of liberal measures, was sent over as lord-lieutenant. He commenced his government by arrangements for bringing in a bill for the total repeal of the penal statutes, and by the removal from office of the inferior agents of government, who, by their long continuance in place, and the manner in which their mutual interests were connected, virtually possessed the supreme power. The latter of these efforts caused the lord-lieutenant's removal. The family of the Beresfords, which had for many years possessed the chief places of profit and influence, remonstrated effectually against their own dismission and the breaking up of the old system, and Earl Fitzwilliam was suddenly recalled. Earl Camden, who succeeded him as lord-lieutenant, recurred to the former system of patronage and coercion. The United Irishmen now looked not to a reform, but to a separation from Great Britain, and the establishment of an independent republic in alliance with that of France, as the only means of securing the independence of their country. A well-arranged system of secret confederacy was spread over the greater part of the kingdom, headed by an executive in the capital, the members of which, though wholly unknown, except to the few individuals in immediate communication with themselves, issued orders for enlisting, combining, and arming their adherents, which were zealously and implicitly obeyed. The northern and midland counties had for some time been disturbed by the fierce and deadly contentions of the peasantry of the two opposite religious creeds; the Catholics took the name of Defenders, the Protestants that of Orangemen. As the struggle grew more desperate, the attraction of party extended to the higher classes, and the former of these predial disturbers merged into the great mass of United Irishmen, whilst the latter, consolidated by the infusion of a superior spirit of wealth and intelligence, formed a compact, well-organized, and resolute body, under the original name of Orangemen, determined to maintain to the utmost their own monopoly of power, and the entire exclusion of the Roman Catholics, who formed the great mass of the population, from any participation of it. The increasing hostility of both parties showed itself by acts of augmented atrocity on both sides. The Defenders' means of aggression were nocturnal plunder, house-burnings, and murders. The other party, backed by the sanction of the government, had recourse to the force of statutes of increased rigour, and, where these failed, to the agency of military violence beyond the law. In the year 1796 the organization of the united system on the one side, and on the other the increased severities of the Orangemen, supported by the government, and directed exclusively against the Catholic peasantry, compelled the leaders of the people to press upon the French government the necessity of an immediate invasion. In consequence of their repeated and urgent applications, aided by the exertions of Wolf Tone, who, since his departure from Ireland, had devoted himself to this object, a large armament was equipped in the western ports of France, for the avowed purpose of invading Ireland. The command of it was intrusted to Hoche, then considered as the first officer of the time. Taking advantage of a storm which drove the blockading squadron of England off the coast, a large fleet sailed from Brest under his command in the middle of December; but the same violence of weather which afforded it the opportunity of eluding the vigilance of the British navy dispersed it when at sea, insomuch that but a part of the armament arrived on the coast of Ireland. Having lain for some time in Bantry Bay undiscovered by the enemy, waiting the arrival of the general, who had embarked in a frigate, and finding the further continuance on the station every day more precarious, it departed, contrary to the pressing remonstrances of Wolf Tone, and returned to Brest, whither the remainder of the fleet soon afterwards arrived, with the loss of a few ships. A second expedition from the Dutch coast was equally unsuccessful. The possibility of an invasion being thus demonstrated, and the probability of its ultimate success, if effected on a great scale, being apprehended in the present excited state of the public mind, the government had recourse to still stronger measures to put down the spirit of insurrection. The habeas corpus act was suspended, domiciliary visits throughout the country parts were frequent, meetings of the people were dispersed by violence, torture was inflicted to force confession from suspected persons, and bodies of soldiery were allowed to live at free quarters in suspected districts. The relaxation of discipline and consequent outrages arising from these practices caused General Abercromby, who came over to take the command of the army at this juncture, to declare, in general orders to the troops, that "the army was in a state of licentiousness which rendered it formidable to every one but the enemy." The announcement was as unpalatable as it was harsh. The general was recalled. General Lake was sent in his place. By his commands the soldiery exercised an almost uncontrolled authority, in which they were sanctioned by instructions from the government empowering the army to use force at the discretion of the officers against the people. At the same time the strength of the United Irish Association was considerably impaired by the arrest or flight of the executive, caused by the treachery of some of their own body. This circumstance, however, produced no despondency. On the contrary, it led to increased exertion. A new executive was formed, and a resolution adopted to press forward the insurrection without waiting for French assistance. A second act of treachery baffled this effort. Twelve of the leading members of the United Irishmen were seized, with their papers, whilst in committee. A third act of treachery led to the disclosure of the details of the plans. Captain Armstrong, of the king's county militia, entered the association for the purpose of betraying its leaders. By his information two barristers of the name of Sheares, brothers, were arrested; and shortly afterwards, Lord Edward Fitzgerald, a brother of the Duke of Leinster, to whom the chief command of the insurrection had been intrusted, was seized in his place of concealment in Dublin, and carried to prison, where he soon after died either of his wounds or from his treatment whilst there. Notwithstanding these checks, the insurrection exploded at the time arranged by its leaders. On the evening of the 23d of May, the United Irishmen assembled in large bodies in the neighbourhood of Dublin and the adjoining counties. The warnings previously given to government were sufficient to provide against the intended attack upon the capital. The parties collected in its neighbourhood were easily dispersed, with the loss only of a few lives. Unfortunately the same vigilance did not extend to the more distant parts. The signal for commencing operations on the side of the insurgents was to be the non-arrival of the mail coaches at their respective places of destination. The northern and western mail coaches were stopped. The town of Naas was attacked, but, owing to an anonymous warning, the garrison was prepared, and the assault was repelled. Unsuccessful attacks were also made on Carlow, Hacketstown, and Monasterevan. A large body which had assembled on the hill of Tarah was routed with much slaughter. The operations of the army were seconded by the most violent acts on the part of the government. Several of the leaders who had been previously seized were tried and executed. Numbers arrested on suspicion were brought to places prepared for the purpose, and there tied up and flogged, to extort confession. The principal places in Dublin for these inquisitorial executions were the Royal Exchange, the Old Custom-House, the Prevot Barrack, and a riding house belonging to a cavalry corps commanded by one of the Beresford family. The atrocities practised in the capital under the sanction of the government were improved upon in the country parts, where the military, to whom full license was permitted, by putting the country under martial law, not only adopted the same method of extorting confession, but used others of more refined agony to elicit discoveries or to gratify revenge. In some cases they hanged up their victim, and let him down again just before life was extinct; thus repeating at pleasure the sufferings of strangulation. On the heads of others they applied caps lined with heated pitch, which, when fastened on, and allowed to cool, were suddenly torn off, carrying with them the hair and skin. In the spirit of fiendish mockery, they cut ridges in the hair of others, in the form of a cross, and filling up the furrow with gunpowder, set fire to it. On the first breaking out of the rebellion, a number of suspected persons, some of them respectable farmers, who had been confined in a racket-court at Hacketstown, were deliberately shot, without even the form of trial, on the removal of the troops from that place, lest they should join the rebel camps. A similar massacre was perpetrated at Dunlavin. The insurgents of Kildare, finding themselves defeated in almost every assault upon the king's troops, came forward to surrender on promise of pardon. Many laid down their arms, and were permitted to disperse in safety. But a large body of them, assembled for the same purpose, was unexpectedly attacked by a detachment of the military, who had not been made acquainted with the arrangement, and cut to pieces.

The system of torture was carried by the soldiery into the county of Wexford, which had hitherto remained quiet.

Here the insurgents were more successful. After cutting to pieces a detachment of cavalry from Dublin, and another of infantry and artillery from Duncannon Fort, and taking Enniscorthy by storm, they seized on the town of Wexford, which had been evacuated on the first alarm by the military. Having established themselves here, and at Vinegar Hill, an eminence near Enniscorthy, they remained comparatively quiet, being chiefly occupied in putting to death prisoners charged with having been active in the cruelties practised upon the insurgents. Their first serious defeat was at New Ross, from which they were repulsed after a sanguinary contest of ten hours. In revenge for this defeat, a party of the fugitives set fire to a barn at Scullabogue, in which upwards of an hundred of their prisoners were confined, all of whom were either burned, or piked in attempting to escape from the flames. The same impulse of sanguinary despair caused the insurgents in Wexford to put their prisoners to death, by piking them on the bridge, and flinging their bodies into the sea; a process of cruelty continued for several days, notwithstanding the active interference and remonstrances of several of their own clergy. At length, however, their main position at Vinegar Hill was invested by a large military force, and stormed after a short resistance. Wexford soon afterwards fell into the hands of the royal troops, having surrendered without resistance, on conditions which were immediately violated. The leaders of the insurrection who had not fallen in the field were executed by court-martial, and the insurrection in this and the neighbouring county of Wicklow totally suppressed.

The news of the first successes of the insurgents in Wexford caused a rising in the counties of Antrim and Down, which had remained passive on the first breaking out of the insurrection in Kildare. But it was speedily put down after a battle in the town of Antrim, and another at Ballynahinch, in both of which the insurgents, who displayed much courage, but no military skill, were totally defeated. The marauding parties, who still harassed the country after the dispersion of the main bodies, were ultimately broken up by the prudent and merciful conduct of Lord Cornwallis. This nobleman, who succeeded Earl Camden as lord-lieutenant, not only put an instant stop to the system of torture and extermination which had been adopted and perseveringly acted on by his predecessor, but issued an amnesty to all who submitted and returned to their dwellings. This merciful policy had its full effect; and the country, after being convulsed for two months by the deadly struggles of the contending parties, entertained the hope of being restored to tranquillity, when the prospect was suddenly overcast. Towards the close of summer, a small French squadron landed a force of about twelve hundred men at Killala, in the west of Ireland. Humbert, the general, being joined by a number of the inhabitants, pressed on to Castlebar, where a force of from five to six thousand men under General Lake was posted to oppose him. This force was taken by surprise, and routed almost without firing a shot. The French then proceeded to Coolooney, where they received a temporary check from a party of the Irish militia, which made a gallant stand against superior numbers; and thence proceeded, followed by General Lake, into the county of Longford. Having arrived at the village of Ballynamuck, the French commander, finding himself surrounded by an overwhelming majority of force, collected from all parts by Lord Cornwallis, surrendered at discretion, leaving his Irish auxiliaries to the mercy of the enemy. No quarter was given to these. A second attempt at invasion, equally feeble and futile, was made the following month. A small squadron appeared off the northern coast, filled with troops intended for disembarkation; but it was routed by a superior English fleet, with the loss of one line-of-battle ship and six frigates, in which were some of the expatriated Irish who were embarked in this desperate expedition. Amongst these was Wolfe Tone, who, on being brought prisoner to Dublin, anticipated the sentence of a court-martial by an act of suicide.

The explosion of the insurrection hastened on the steps for effecting a legislative union, long a favourite measure with the British minister. The intention was announced in the lord-lieutenant's speech at the opening of the parliament in 1799. After a discussion of upwards of twenty-four hours in the lower house, a resolution approving of the principle was carried by two voices, a majority so small that it was viewed on both sides as tantamount to a rejection of the question. In a subsequent debate the opinion of the house was more expressly declared against it by a majority of five. The public discussion of the subject being thus suspended by this expression of a majority of the representatives of the people, the Irish government employed itself for a renewal of the effort, by bringing into action every means of intimidation and influence at its command. Public meetings convened to express sentiments adverse to a closer connection with Great Britain, were either prevented or dispersed by military authority; tenders of honours and emoluments were lavished upon all who possessed the means of influencing the votes of members of the House of Commons. The great body of the people were induced to give the measure a tacit though reluctant assent, from a promise held out to them of Catholic emancipation as its result. Confiding in the success of these arrangements, Lord Castlereagh, the Irish minister, revived the question early next session; and, on a division, found himself at the head of a majority of forty-two, notwithstanding the violent and impassioned exertions of all adverse to the measure, which proceeded even to a hostile collision between two of the leaders of the contending parties, Mr Grattan, and Mr Corry, the new chancellor of the exchequer, the latter of whom was wounded on the occasion. The principle being thus admitted, the details were easily arranged, as they had been settled by the British parliament during the late session; so that at the close of the year the two separate parliaments of Great Britain and Ireland were dissolved, never to meet again, and a proclamation issued for the assembling of an imperial parliament in January 1801. The principal articles of this international treaty are,—1. The permanent union of the two kingdoms into one, under the name of the United Kingdom of Great Britain and Ireland. 2. The succession to the throne to continue limited as at present. 3. The kingdom to be represented by one parliament, to be called the Parliament of the United Kingdom of Great Britain and Ireland. 4. Twenty-eight peers temporal elected for life, and four spiritual peers succeeding each other by a rotation of sessions, were admitted into the House of Lords; one hundred representatives, two for each county, two for Dublin city, two for Cork city, and one each for thirty-one towns and the university, were to be elected into the lower house. 5. The churches of England and Ireland were to be united into one, to be called the United Church of England and Ireland, the doctrine, worship, and discipline of which was to be the same as that established for the Church of England. 6. The subjects of Great Britain and Ireland were to be placed on the same footing as to manufactures, trade, and commerce. 7. The contribution of each portion of the empire towards the general expenditure was to be in the proportion of fifteen to two between Great Britain and Ireland for twenty years; after which, to be regulated at the discretion of parliament. 8. The existing laws and courts of justice in each island were to continue as heretofore, except that appeals from the Irish chancery were to be brought before the House of Lords in England.

History. The style of the king was in consequence changed to that of king of the United Kingdom of Great Britain and Ireland, and the blazoning of the royal standard was altered accordingly.

The act of union, after it had been carried by an unprecedented combination of corruption and intimidation, did not at once produce the results promised by its advocates. It neither tranquillized the country, nor aided the consolidation of its resources. The Protestants, who constitute the aristocracy, found their influence diminished by it. The Catholics soon discovered the hopelessness of the expectation of being thereby admitted to the rights of freemen. When the question of their emancipation was about to be made an object of discussion, it was now for the first time publicly announced that the king had insuperable objections to the measure. The consequence was a change of ministry, which was followed up by legislative measures of great severity towards Ireland, founded on a suspected apprehension of the existence of a secret spirit of disaffection there. Martial law was re-enacted, and the acts for the suspension of the habeas corpus, and for preventing seditious meetings, were revived. These measures of prospective severity did not prevent the mischiefs apprehended. In 1803, less than three years after the passing of the act, an insurrection, devised and matured by a gentleman of the name of Robert Emmett, the younger brother of a barrister of the same name who had expatriated himself in consequence of the leading part he had taken in the proceedings of the United Irishmen, broke out in the city of Dublin. Its explosion was so sudden and unexpected, that no suspicions, at least none strong enough to lead to the adoption of measures of precaution, were entertained by the government. Soon after sunset on the 23d of July, Mr Emmett, at the head of a number of his followers, armed chiefly with pikes, issued from a depôt established by him in an obscure street in the west of Dublin, and after cutting down some of the military who were proceeding individually to their several quarters, moved towards the Castle, the main object of attack, when his followers were delayed by the approach of Lord Kilwarden's carriage. This nobleman, who had been chief justice of the King's Bench during the late troublous times, was coming into Dublin as a place of security, in consequence of a rumour of a rising having reached him in his villa, a few miles from town. On being recognised, he was immediately assailed, mortally wounded, and lingered only about two hours. His last words were, an entreaty that none engaged in the insurrection should be put to death without trial. His daughter and his nephew accompanied him in his carriage; the latter was killed on the spot, the former was allowed to pass unmolested through the crowd, every one exclaiming that the lady must be spared. The arrival of two small piquets immediately dispersed the collected multitude, with the loss of a few lives. Emmett, on finding the failure of his scheme, escaped to the neighbouring mountains, where he was soon afterwards taken, brought to trial, and executed. Thus died a young man of good family, superior talents, and enthusiastic zeal for the independence of his country, through a deplorable error of judgment, in endeavouring to attain an object in itself so honourable, by means totally inadequate to its magnitude, and attainable through a frightful expenditure of human life. A similar attempt at insurrection was arranged in the north of Ireland by an associate of Emmett, of the name of Russell. It was discovered before the time fixed for its explosion. Measures of prevention were adopted, and its leader, being soon afterwards taken in his place of concealment in Dublin, was also executed. The whole transaction was but the act of an hour; its only permanent consequence the revival of statutes of extreme severity, which, by placing the people beyond the protection of the usual course of law, served to foster in the mind the seeds of discontent and disaffection, which it was the professed object of such legislation to extinguish.

The agitation of the feelings of mutual irritation between the two great parties in Ireland, arising from the late insurrection, had not sufficiently subsided to admit of the most distant hope that the Catholic claims would receive the slightest attention in parliament until 1805. Even then, so powerful was the party adverse to the entertaining of the question in any manner, that motions for a committee on the petitions of the Catholics presented in that year were rejected in both houses by overwhelming majorities. Even a bill, which asked no more than to put Roman Catholic officers in the army on the same footing in the English as they were in the Irish service, brought in by the then ministry, led to a dissolution, both of the administration and of the parliament, in consequence of the king's aversion to it. For several years afterwards, the question was periodically mooted in one or both houses of parliament, and uniformly rejected, though on each subsequent occasion by a diminished majority against it. In 1811, so little were the rights of conscience respected, so little regard was paid to the religious feelings of Catholics, that soldiers of that persuasion were sentenced to do duty with their coats turned, in consequence of having attended at the public worship of their own church. The effect of the punishment was directly the reverse of that intended. Such a wanton insult on the feelings of the great body of the people excited universal disapprobation, and an order was issued, not merely to permit the Catholic soldiery to be present at their own places of worship, but to take care that they should proceed thither in military order.

The Catholic committee, which had sat under various names and forms from time to time ever since its original institution in 1756, having, in 1811, proposed to assemble by delegation in Dublin, steps were taken by the government to put it down, as being contrary to the convention act, which prohibited such assemblages, and one of the members, Dr Shendan, was prosecuted; but, in consequence of his acquittal by a Dublin jury, no further proceedings were then taken. About the same period the exacerbation between the members of the two great parties, the Orangemen on one side, and the Catholics on the other, led to frequent personal collisions among the lower classes, which terminated in bloodshed in several places. In 1817 public opinion had advanced in favour of the Catholic claims so far as to admit of the question of securities being a topic of discussion both in and out of parliament. The royal exertion of a veto in the nomination of the Catholic hierarchy was now the great point. A letter on the subject from M. Quarantotti, president of the sacred missions at Rome, to Dr Poynter in England, in favour of it, excited much controversy. The general feeling of the Catholics of Ireland against any ministerial interference with the ministers of their religion was decisive and strongly marked. The question therefore was dropped.

During these protracted and angry discussions, it was not to be expected that the internal prosperity of the country could have increased. On the contrary, the sanguine anticipations of the advocates of the union, as to its good effects on the great interests of Ireland, were so far from being realized, that, in 1817, the public debt of the country had increased to such a magnitude as to threaten a national bankruptcy, which was averted only by the consolidation of the exchequers of the two great parts of the empire; Great Britain thus being made responsible, if not for the discharge of the principal, at least for the regular payment of the interest, of the Irish debt. Three years afterwards, the failure of ten private banking-houses, one in

Dublin, and the others in the south and west, caused a general stagnation of trade. The greatest distress among the working classes was the consequence. In 1821 the king (George IV.) proposed to visit Ireland, with the view, as was universally understood, of establishing, by his personal interference, a bond of amicable relations between all classes of Irishmen. He landed on his birth-day, was enthusiastically received, entered Dublin with a splendid retinue, visited all the public institutions, conferred some honours, and, after a visit of about six weeks, spent partly in the metropolis, partly at the mansion of the Marquis of Conyngham, in the county of Meath, he quitted the country, as he had entered it, amidst the acclamations of congregated thousands. Previously to his departure, a letter was issued by his order, expressive of his gratification at the reception he had met with, and of his desire of the mutual good will of his subjects. But his visit effected nothing. The remedy was too superficial, too evanescent, to effect a cure; the cause of irritation remained still untouched, rankling in the heart's core of the community. Shortly after his departure, the feud that had been lulled by respect and expectation broke out anew. Catholics and Orangemen were again opposed to each other. The insurrection act was again called for, and granted. In 1822, the failure of the crops produced a state of destitution truly appalling. It was relieved by the generous exertions of the people of Great Britain, who, when informed of the exigency of the case, through the instrumentality of Mr J. Smith, a London banker, and member of parliament, came forward with a liberality of contribution, which, aided by the efforts of the government, thus directed to the knowledge of the existence of an evil that it ought to have foreseen, checked the consequences of extreme famine.

In 1823 the Catholic question began to assume a new and more imposing form. Its change of character was owing to Mr Daniel O'Connell, a barrister, who, after having signalized himself on his first entrance into political life by his energetic and eloquent protest against the extinction of the parliament of Ireland, had been subsequently an active and most influential actor in all the proceedings of the Catholic body. Deploring, alongst with his friend and coadjutor in political action Mr Shiel, the state of torpid depression in which the question now seemed sunk, he suggested the revival of a central body to advocate and manage their cause, planned its details, and commenced its organization. The first meeting of this body, so soon, under the name of the Catholic Association, to be the acknowledged organ of the public sentiment of the greater part of the population of Ireland, commenced in a meeting of three individuals, of whom O'Connell himself and Sheil were two. Its distinguishing characteristics were the exclusion of any thing savouring of delegation, a strict adherence to the letter of any law that had been or might be enacted in order to stifle the expression of the sentiments of the Catholics, and, above all, the admission of the great body of the people into it. This last element of its constitution was finally secured and firmly grafted into it, after a precarious struggle for existence for some time, by a pecuniary contribution, which Mr O'Connell, its inventor, as sagaciously as quaintly denominated "the Catholic rent." By this every Catholic was called upon to subscribe at least one penny per month to defray the expenses of the association, and thereby became a member of it. These expenses were far from inconsiderable. They were applied partly to protect poor Catholics from the petty persecutions of intolerant magistrates and landlords, partly to meet the general expenditure of the association, whose communications with all parts of the country could not otherwise be effectively carried on, and partly for the gratuitous circulation, throughout every part, of a newspaper, containing a detail of all the proceedings and debates of the association. Opportunities soon presented themselves of displaying the powers of the organization thus devised. The first was the consequence of an act passed for its suppression, which, from its severity, was nick-named "the Algerine act." Its operation was so parried by the ingenious management of the association, as to render it ineffective, and the association continued to meet in open submission to its provisions, but in virtual defiance of them. The second was, if not more effective, certainly more imposing. The county of Waterford had for more than seventy years been represented by a member of the Beresford family. On the dissolution of parliament in 1826, the Catholic, or as they now began to style themselves, the liberal party, resolved to throw off the yoke to which they had tamely submitted for nearly a century, and to send into parliament a representative of their own choice, without regard to any accustomed rules of family claims or rights of landlords. Mr Stewart, a young gentleman of large fortune, then travelling on the Continent, was invited to stand as candidate. He obeyed the call, and in a few weeks arrived in Waterford. The preparations for a contest were at first disbelieved or derided by the county aristocracy. So far were the landlords from an apprehension of a disruption of the old bond by which they heretofore held their tenantry engaged to obey their dictates in the choice of a representative, that the Duke of Devonshire, who, though, as a liberal, he would not openly take part with the Beresfords, yet wished to maintain the long-established custom of the tenants' subserviency, declared, that "though, from respect to the constitutional rights of the people, he refused as a peer to interfere with the votes of his fifty-pound freeholders, he expected *of course* that his forty-shilling freeholders would abstain from giving their votes to either of the rival candidates." His dictation was to no purpose. When the day of election arrived, his as well as all the other Catholic tenantry voted for the new candidate, so that at the close of the fifth day's poll the brother of the Marquis of Waterford, hitherto the undisputed nominee of the family, relinquished the contest in despair. The example of Waterford was followed in Louth, Monaghan, and Westmeath, in each of which counties popular feeling triumphed over family influence in the choice of a representative.

The dissolution of Mr Canning's ministry by the unexpected death of its leader, and the formation of that of the Duke of Wellington, gave a character of increased energy to the Catholic struggle. Mr Canning had appointed the Marquis of Anglesey to be lord-lieutenant. The sentiments of this nobleman upon the Catholic question were little known; but the apprehensions of his hostility entertained by many on his first arrival were quickly dissipated. The association was not suppressed, coercive statutes were not called for; the people were suffered to discuss and to petition without official interruption, as long as they restrained themselves within the limits prescribed by law. On the Duke of Wellington's succession to power, he was universally believed to be decidedly and irreclaimably adverse to concession. One of the first measures then taken by the Catholics, was the adoption of pledges to be given by every candidate, on an election, to oppose his administration. These pledges were intended for the next general election. An earlier opportunity of trying their efficacy presented itself. A vacancy was occasioned in the representation of Clare, by one of the county representatives, Mr Vesey Fitzgerald, accepting a place in the cabinet. Mr Fitzgerald had always been an advocate for Catholic emancipation; he was a resident landed proprietor, of amiable manners; and his father had resigned a lucrative post at the bar rather than vote against the feelings of the country on the question of the union. But he was the nominee of the Duke of Wellington, the reputed enemy of the Catholics. He therefore came within the mean-

History. ing of the pledges, and was to be rejected if the Catholic power in Clare was sufficient for the effort. A new difficulty presented itself. The candidate chosen by the people refused to stand in opposition to Mr Fitzgerald. The day of election was hastening on. No other suitable resident was to be found to supply his place. In this emergency Mr O'Connell, the leader of the Catholic body, the founder of the Catholic Association, stood forward and offered himself. The result was the same as at Waterford. The election terminated in an overwhelming yet peaceful triumph. Mr O'Connell was the acknowledged representative of the county of Clare, the first Catholic returned to sit in the imperial parliament of Great Britain.

For some time previous to this event, the Orange or anti-catholic party, alarmed at the rapid progress of their antagonists, and the high position they were on the point of attaining, had banded themselves into a new system of counter-association, under the name of Brunswick Clubs, the avowed object of which was to resist any further concessions to the Catholics. Both parties now every day presented more and more the aspect of uncompromising hostility. Their speeches assumed the character of mutual denunciation. The arm of each was all but lifted up. Each seemed to wait only that his antagonist might strike the first blow, and be the first to outstep the bounds of constitutional resistance. In this awful pause, the liberal Protestants, who had hitherto advocated, mildly, if not timidly, the cause of the Catholics, felt that their own safety and that of their common country required more decided measures. Mr John David Latouche, a banker in Dublin, the head of a family long known and respected for extensive benevolence and liberal political sentiments, prepared a declaration expressive of the necessity of parliament taking the whole subject into its immediate consideration, with a view to its final and conciliatory adjustment. Copies of this declaration were circulated throughout all parts, and in a singularly short period it received the signatures of sixty-nine peers, either Irish, or holders of large properties in Ireland, and upwards of two thousand other landed proprietors. At this crisis the Marquis of Anglesey was suddenly and angrily recalled, in consequence, as was universally believed, of his recommendation to the Catholics, expressed in a letter to their primate, of peaceful but determined perseverance in the pursuit of their rights. An impression now prevailed amongst parties that this act was decisive as to the Duke of Wellington's determination to resist all concession. The Brunswick Club held its meeting in Dublin. Its bearing was that of boldness and defiance. The liberal Protestants, who had as yet assumed no specific title of recognition, determined on an antagonist meeting. It was held in January, and was even more numerously attended than its most zealous devisers had anticipated. Petitions to the king and both houses of parliament for the total repeal of all the laws disqualifying the Catholics were adopted; and the basis was laid for the formation of a society of united Protestants and Catholics, for the attainment of civil and religious liberty, under the name of the Irish Association. The unexpected change in the measures of the king's government towards Ireland rendered any further progress in these projected plans unnecessary. The Catholic emancipation bill passed on the 13th of April 1829, clogged indeed with two provisos not quite in unison with the spirit of liberality that marked its main enactments. The one was general in its object, the disfranchisement of the forty-shilling freeholders; the other was personal, excluding Mr O'Connell, not by name, but virtually, from the seat to which he had been nominated at the late Clare election. The latter exception proved altogether futile. Mr O'Connell was again returned at the next election. The attainment of Catholic emancipation was followed by a loud though not universal demand for the repeal of the legislative union, and for the abolition of tithes; an impost considered as degrading in principle, as it was felt to be oppressive in the mode in which it was levied. The reform question also was added to the number of stimulants of the public mind. This last-named subject of irritation has been laid at rest in a manner not so satisfactory to Ireland as to the other great divisions of the empire, but so as to lead to reasonable hopes of its progressive efficacy. The question of repeal has been silenced as far as can be done by an authoritative declaration of one, and that one the more powerful, of the parties interested in its decision; the tithes still remain a question, no longer of Irish, but of imperial interest.

STATISTICS.

Statistics.

Dimensions. The island of Ireland is of a rhomboidal shape, having its longer sides nearly in the direction of the meridian, and its shorter from south-west to north-east. It lies between the latitudes of 51. 26. and 55. 20. north, and the longitudes of 5. 28. and 10. 28. west. In the direction of its greater diagonal, from Browhead in the south to Fairhead in the north-east, it measures 306 miles. Its extreme length, from its most southern point, already named, to Walinhead, its most northern extremity, is 290 miles; its greatest length on a meridian 235 miles. Its breadth where greatest, measured from Emlagh-rash, in the peninsula of the Mullet, to Killard Point, at the entrance of Strangford Lough, is 182 miles; but its least breadth, from the eastern side of Galway Bay, near Oranmore, to Ringsend, near Dublin, is not more than 110 miles. The whole comprises an area of 20,499,550 acres, or 320,312 statute miles. Separated from the adjacent island of Great Britain by an arm of the sea not more than forty-nine miles across at its southern extremity, and narrowing to twelve miles at the north, but expanding in its intermediate space into the Irish Sea, it is washed on its three other sides by the Atlantic Ocean, whose waves have indented its western and southern shores with many large bays and inlets, trenching far into the country; so that the whole outline of the coast, including that of the estuaries of the great rivers, to the boundary of the tide, is estimated to measure upwards of 2200 miles. Boundaries.

Coasts. This extended line contains a great number of fine harbours and roadsteads. The eastern coast has but one; that of Strangford or Lough Cone, which forms a very deep bay, with sufficient depth of water for every kind of ship. The bays of Carrickfergus, Dundalk, and Carlingford, are adapted only for vessels of lesser draught; Dublin is so defective as to require the construction of two safety harbours; one to the north, at Howth, and the other to the south, at Kingstown. The coast to the south of Dublin affords no shelter for large ships; Wicklow, Arklow, and Wexford, admitting only vessels of very small size. This part of the coast is also dangerous, from the shoals which extend along it near the land. On the southern side of the island is the fine estuary of Waterford, formed by the confluence of the Suir, Nore, and Barrow. Here ships of large burden can discharge at the quay of Waterford. Farther on is Cork Harbour, securely land-locked and protected by large batteries, and therefore chosen as the principal naval station on the Irish coast in time of war. Still farther are Baltimore Harbour, Long Island, Skull, Cape Clear, Crookhaven, Dunmanus, and Bantry Bay, all of sufficient depth and capacity for the largest ships. A French fleet, designed for the invasion of Ireland, lay in the last named of these in the winter of 1796. Turning westward are Berehaven, Quoylagh Bay, Kenmare River, and Kilmichalog and Sneem Harbours, Valen-

Statistics. tia, Ventry, Smerwick, and Brandon Bay. The estuary of the Shannon contains several good stations. Farther north is Galway Bay, also containing several smaller ones; Casheen, Kilkerran, and Roundstone Bays, the last of which is capable of containing the whole navy of Britain; Birter Bay, Ardbear or Clifden, Cleggan Bay, Ballynakill and Killery Harbours; Clew Bay, within which a numerous archipelago of islets affords many safe stations. Proceeding still in a northern direction is Blacksod Bay, Broadhaven, Killala Bay, Killibegs Harbour, and Macswine's Bay. On the northern coast are Milroy Harbour, and the two fine gulfs of Lough Swilly and Lough Foyle. The harbours and inlets for the reception of smaller vessels are too numerous to admit of detailed enumeration. In short, there are upwards of seventy harbours well suited for the general purposes of commerce, and fourteen capable of accommodating large naval armaments.

Islands. The islands near the shore are numerous, but few of large size. Their total number is nearly an hundred and fifty. Amongst the most remarkable are, on the north shore, Rathlin or Raghery, celebrated for its basaltic formation; Tory, Ennisbofin, and the Rosses, the largest of which is Arranmore. On the west, Enniskea, Achill, Clare, Ennisbofin, the southern islands of Arran at the entrance of Galway Bay, the Blasquets, and Valentia. On the south are Bear and Whiddy in Bantry Bay; Cape Clear, long supposed to be the most southern point of Ireland; and Cove Island, in Cork Harbour. The few islets on the eastern coast are uninhabited, except one. The most remarkable of these are, Dalkey, Ireland's Eye, Lambay, the Skerries on the coast of Dublin, and the Coplands at the entrance of Carrickfergus Bay. The population of all the coast islands is estimated at 43,000 souls. They are thus classed as to provinces.

Provinces.	Total Number.	Inhabited.	Population.
Leinster..........	6	1	34
Ulster............	40	27	4,546
Munster..........	70	50	22,827
Connaught.......	80	60	15,592
	196	138	42,999

Surface. The surface of the country is, generally speaking, plain, yet not altogether level, but rising in most parts into hills of small elevation. The most level parts are in the centre, in a band extending across the island from Dublin to Galway, in which the land rises gradually from the coast, to a height of 322 feet. The hill of Moat-a-Grenogue, in Westmeath, is the highest point of the plain. Both in the north and south the land rises into heights much greater, but none of such elevation as to retain the snow during any long period of the year; the most elevated point in Ireland not attaining to the range of 3500 feet above the

Mountains. level of high water. The mountains form groups rather than chains. The highest is in the west of Munster, the next in height in Leinster, the third in Ulster, and the fourth in Connaught. All are near the coast. The comparative altitudes of the highest points in each group are as follows:

Munster,	S. W.	M'Gillicuddy's Reeks, Kerry....	3410
		Mangerton, Kerry..................	2693
Leinster,	S. E.	Lugnaquilla, Wicklow............	3070
		Thonalagee, Wicklow.............	2696
Ulster,	N. E.	Slieve Donard, Down.............	2809
Connaught,	N. W.	Muilrea, Mayo.......................	2737
		Croaghpatrick, Mayo..............	2660
		Nephin, Mayo.........................	2630
		Furmnagur, Mayo..................	2569

Rivers. The largest river is the Shannon, which, rising in the mountains in the confines of Fermanagh and Leitrim, flows through Lough Allen, and thence in a south-western direction, separating Connaught from Leinster, till, arriving at Limerick, it turns westward, and discharges itself into the Atlantic, through a fine estuary, which, at its entrance between the capes of Loophead and Kerryhead, is eight miles wide. It is navigable for large vessels to Limerick, near which its course is checked by natural obstacles. During its passage from Lough Allen to Limerick it expands into the large lakes of Lough Reagh, fifteen miles, and Lough Dearg, twenty-one miles, in length. Each of these is narrow, and studded with numerous islets. The Blackwater rises near Charleville, and, flowing south-eastwards, discharges itself into the Atlantic at Youghal, after forming the boundary between the counties of Cork and Waterford. Between the latter county and that of Wexford is the estuary of the Suir, the Nore, and the Barrow, all of which have their sources not far from each other in the central range of the Slievebloom Mountains; and, after diverging so that their streams enrich a great portion of the provinces of Leinster and Munster, unite again near the city of Waterford. The Slaney rises in the mountains of Wicklow, and empties itself into St George's Channel at Wexford. The Boyne, famous for its historical recollections as well as for its natural advantages, has its sources in the central elevated plain of Leinster, and, flowing north-eastwards, falls into the Irish Sea at Drogheda. The Bann rises in the Mourne Mountains, flows northwards through Lough Neagh, and, after separating the counties of Londonderry and Antrim, flows into the Atlantic at Coleraine. The Foyle is formed by the union of the streams of the Poe, the Mourne, the Finn, and the Derg, which, flowing from different parts of the interior of Ulster, discharge their combined waters into Lough Foyle near Londonderry. The Erne, which gives vent to the waters of Lough Erne, has a short course to the Atlantic westwards, checked by several ridges of rock, which form fine falls. The other rivers, though numerous, amounting nearly to an hundred, are small, and mostly confined to the counties that give them birth. The Liffey, which rises in the mountain-land of Wicklow, and, after a circuitous course through Kildare, discharges itself into the Irish Sea, is remarkable for little more than that Dublin city, the metropolis of the island, is seated on its banks.

Lakes. The lakes are numerous. Lough Neagh, in Ulster, is the largest. It covers 97,272 acres at high-water mark. The river Bann passing through it affords the means of lowering its surface, if such a process should be deemed advisable; but as its lowest part is beneath the level of low water, its total drainage would be impracticable. Tradition states that it was once dry land; and the boatmen assert that the tops of buildings may at times be seen in it. It contains but one islet, Ram Island, remarkable only for a round tower. Its vicinity to five of the most agricultural and manufacturing counties of Ulster, Antrim, Down, Armagh, Tyrone, and Londonderry, each of which its waters touch, present great advantages for internal trade by inland navigation. This lake has long been celebrated for its petrifying qualities, by which trunks of trees have been converted into a siliceous substance. Lough Erne, the next in size, lies wholly within the county of Fermanagh. Its total length is upwards of forty miles, but its greatest breadth is not more than eight. Strictly speaking, it consists of two lakes; the more inland measuring about fourteen miles in length, and that nearer the sea twenty-five. They are connected with one another by a narrow channel, on which the town of Enniskillen is built. Its area covers 48,797 acres, and it is adorned with upwards of an hundred islets. The level of its waters is 140 feet

Statistics. above the sea. Its coasts are studded with numerous seats and villas of much beauty. Lough Corrib and Lough Mask, in the west of Connaught, are separated from each other by an isthmus not more than three miles broad. The former of these lakes is thirty miles long, and from nine to ten broad in some places. It discharges its waters into Galway Bay by a short but broad and rapid river, which skirts the town of Galway. Though its level is but fourteen feet above that of the sea, the means of connecting them by water communication has not yet been effected. Lough Mask is of smaller dimensions, and has attached to it Lough Gara, still more diminutive. Farther north is the narrow lake of Lough Conn, fourteen miles long. The other lakes are too numerous, and not of sufficient importance as to size or local peculiarity, to admit of a detailed description. Most of them lie in the central plain, particularly in the counties of Cavan, Westmeath, and Longford. From this sweeping exclusion a few must, however, be excepted. Lough Lane, or the Lake of Killarney, in Kerry, has long been celebrated for its picturesque scenery. The tract of water distinguished by this name consists of three parts, connected by short straits. Lough Derg, in the south of Donegal, is small, but of great celebrity from an islet in it called St Patrick's Purgatory, which has been resorted to from time immemorial as a place of penance by pilgrims of the Roman Catholic persuasion. Several attempts have been made to put an end to the religious ceremonies performed there, but without success. It still continues to be visited by multitudes of strangers from all parts, from a reliance on its supernatural qualities. This lake is not to be confounded with the Lough Dearg already noticed as lying on the course of the Shannon. Lough Gill in Sligo, Lough Shellin to the north of Meath, and Lough Oughter in Cavan, are also worthy of notice for their scenic beauties.

Forests. Ireland was once so thickly covered with timber as to receive the name of the Island of Woods. During the early periods of its connection with England, its extensive and impenetrable forests formed a main obstacle to the progress of the English troops. Westminster Hall is said to be roofed with oak cut in the woods of Shillelagh. Numerous trunks of large trees are constantly found in the bogs. Even in mountain tracts devoted for a long succession of years to the pasturage of sheep, timber trees shoot up spontaneously wherever the land is secured from the intrusions of cattle. Many places, where the vestige of a plantation is not to be seen, retain a name of which the word "wood" forms a component part. The extension of agricultural improvement, and more especially the timber act, which gives the tenant, at the expiration of his lease, a pecuniary interest in the trees he has planted, are gradually removing this defect, the consequence of ages of disturbance and desolation.

Bog. To the same cause may be attributed in a great measure the extent of bog with which the face of the country is disfigured. The bogs are chiefly found in the elevated central district. Two lines drawn across the island, the one from Howth to Sligo, the other from Wicklow to Galway, will comprehend by much the greater portion of bog throughout the island. The total quantity, independently of small mountainous and detached patches, has been thus estimated:

Flat red bog, capable of being reclaimed	1,576,000 acres.
Mountain bog, mostly convertible into pasturage	1,255,000
	2,831,000

The bogs are distinguished, according to their substance, into red or fibrous, and black or compact. The former, which consists chiefly of the *Sphagnum palustre*, or bog-moss, is the most general. Its colour is of a reddish brown, approaching when dry to that of an olive. Its surface is generally covered with heath, which gives it a still darker hue. The black bog varies in colour from dark brown to perfect black; in which latter case it is extremely hard and close grained, separating, when broken, into angular fragments. On cutting downwards, the substance grows denser and darker, exhibiting a black mass very compact, strongly resembling pitch or coal, and when ignited emitting a smell so offensive as to prevent its general use as an article of fuel. The peat is found to rest on a blue clay, and ultimately on limestone gravel. The depth of the bogs in some places is nearly forty feet; twenty-five may be considered as a general average. In all cases they are found above the level of the sea. The greatest height of any is 488 feet, the least 25; and they invariably afford easy means of communication to some river by which their superfluous waters can be carried off, where draining is requisite for reclaiming them.

The following table exhibits the area of every county of Ireland, according to a return made to the House of Commons in 1832. It also contains an estimate of the total value of the land, the average value per acre, and a statement of the amount of county rates on an average of the years 1830–1831.

Statistics.

Counties.	Cultivated Land.	Mountain and Bog.	Lakes.	Total Contents.	Total Estimated Value.	Average Value per Acre in Shillings.	County Rates.	No. of County according to Quantity of Land.	No. of County according to Quantity of Arable.
	Acres.	Acres.	Acres.	Acres.	£		£		
Carlow	196,833	23,030	......	219,863	164,895	15	10,326	31	30
Dublin	237,819	10,817	......	248,631	250,201	49	36,150	30	29
Kildare	325,988	66,477	......	392,435	255,082	13	18,904	25	22
Kilkenny	417,117	96,569	......	513,686	437,693	28	19,268	17	16
King's	394,569	133,349	248	528,166	317,019	12	15,095	15	18
Longford	192,506	55,247	15,892	263,645	151,595	11½	10,215	29	31
Louth	191,345	14,916	......	206,261	164,765	32½	11,694	32	32
Meath	561,527	5,600	......	567,127	510,414	18	25,724	13	7
Queen's	335,838	60,972	......	396,810	277,767	14	19,556	24	21
Westmeath	313,935	55,982	16,334	386,251	251,063	13	15,735	26	24
Wexford	545,979	18,500	......	564,479	395,134	14	33,728	14	9
Wicklow	400,704	94,000	......	494,704	296,822	12	18,650	18	17
LEINSTER	4,114,160	635,424	32,474	4,782,058					
Clare	524,113	259,584	18,655	802,352	441,293	11	30,439	7	10
Cork	1,068,803	700,760	......	1,769,563	1,203,936	21¾	84,325	1	1
Kerry	581,189	552,862	14,669	1,148,720	344,616	7½	30,559	5	6
Limerick	582,802	91,981	......	674,783	629,932	33½	36,436	10	5
Tipperary	819,698	182,147	11,328	1,013,173	886,439	17½	52,532	6	4
Waterford	353,247	118,034	......	471,281	295,324	26	21,328	21	20
MUNSTER	3,929,852	1,905,368	44,652	5,879,872					
Antrim	483,048	225,970	49,790	758,808	569,149	15	43,720	8	13
Armagh	267,317	42,471	18,394	328,183	178,955	17	23,655	27	26
Cavan	421,462	30,000	21,987	743,449	307,741	13	23,852	19	15
Donegal	520,736	644,371	......	1,165,107	349,501	6	24,606	4	11
Down	502,677	108,569	158	611,404	489,123	16	37,471	11	12
Fermanagh	320,599	101,952	48,797	471,348	259,241	11	16,795	20	23
Londonderry	372,667	136,038	9,565	518,270	310,962	12	24,849	16	19
Monaghan	309,968	9,236	7,844	327,048	212,581	13	19,643	28	25
Tyrone	555,820	171,314	27,261	754,395	528,065	14	42,893	9	8
ULSTER	3,754,294	1,469,922	183,796	5,408,012					
Galway	955,713	476,957	77,922	1,510,592	868,894	13¼	34,172	2	2
Leitrim	266,640	128,167	25,568	420,375	210,187	10	14,091	23	27
Mayo	871,984	425,124	57,940	1,355,048	550,018	8	21,724	3	3
Roscommon	453,555	131,063	24,787	609,405	379,628	12½	23,070	12	14
Sligo	257,217	168,711	8,260	454,188	227,443	10	19,224	22	28
CONNAUGHT	2,805,109	1,430,022	194,477	4,329,608					
IRELAND	14,603,415	5,440,736	455,399	20,499,500					

The contents in acres of the following cities and towns, each of which is a county in itself, are included in the preceding table in the total contents of the county at large, wherein they are situated. As the average value of land in the counties of cities and towns exceeds considerably that of the county at large, a statement of it is annexed, together with that of the average of the county at large, if taken without such additions:—

Statistics.

City or Town.	Total Contents.	Estimated Value.	Average Value per Acre.		County.	Average Value in County per Acre.	
			s.	d.		s.	d.
Dublin city	8,527	34,108	80	0	Dublin	18	0
Kilkenny city	22,287	44,574	40	0	Kilkenny	16	0
Drogheda town	5,777	14,402	50	0	Louth	15	0
Carrickfergus town	16,524	12,406	15	0	Antrim	15	0
Cork city	44,463	66,694	30	0	Cork	13	6
Limerick city	34,162	85,405	50	0	Limerick	17	0
Waterford city	9,683	18,366	40	0	Waterford	12	0
Galway town	25,059	18,894	15	0	Galway	11	6

Geology. The great central plain, already described as containing by much the larger portion of the bogs, rests on a subsoil of flœtz limestone, which may be considered as in a great measure the substratum of the whole island, as there is in fact but one county, that of Wicklow, in which this rock, either of primary or secondary formation, does not appear. Secondary limestone is much more generally diffused, the primary being found only in the counties of Antrim, Tyrone, Donegal, Londonderry, Sligo, and Galway. The mountainous district in the north consists of three groups of different character. The first is that of the Mourne Mountains, of which Slieve Donard is the summit. Granite is the basis of this group, and of most of its subordinate branches. Hornblende and syenite frequently occur in the borders of the granitic region. The mountainous district in Londonderry and Tyrone, included between the Roe and Mourne, two branches of the Foyle, constitute the second northern group. Its formation is primitive. Most of the country consists of mica slate, accompanied with primitive limestone. In the eastern part is a range of secondary hills, capped by an immense covering of basalt, which spreads itself over the north-eastern part of Antrim. The third group is formed by the two chains which the valley of the Bann passes through in its course to the Atlantic. The formation is secondary, and is invariably covered with masses of stratified basalt, in some places exceeding 900 feet in thickness, but of an average depth of 545 feet, and spreading over a surface of 800 square miles.

Whin dykes. Whin dykes have been found only in the northern region. Most of them are on the coast, none more than fifteen miles from it. They are generally found in groups, several lying within a short distance of each other. They maintain a singular uniformity in their line of direction. Their bearing is constantly from south-east to north-west. Great diversity exists as to their width; that on Arrigle Mountain rises perpendicularly, like a partition wall, to the height of forty feet. Their depth has never been ascertained; but it is observed that their sides never converge, nor do they ever branch off into minute veins, or swell into what are called, in the technical language of miners, bellies.

Basalt. The same part of Ireland exhibits the only specimen of columnar basalt to be found in the island. The Giant's Causeway, in the north of Antrim, is the most remarkable specimen of it. It forms a low point, projecting into the sea, and ultimately covered with water; and consists wholly of prismatic pillars of stone, of various angular forms, all standing upright, each pillar being separated into pieces convex below and concave above, fitting into each other like a pile of dinner-plates or saucers. Along the same shore the precipices which overhang the sea present several other instances of this kind of basalt, one end of which only is visible, the remainder being buried in the mountain. At Doon Point, in the island of Rathlin, on the same coast, is another collection of columnar basalt, differing from that on the main land by having the columns curved or horizontal, as if forced from their perpendicularity by a sudden shock during the process of formation. Traces of a similar columnar formation appear in other parts of the great basaltic mass which covers most of the county of Antrim, where the rock has been accidentally denuded of its surface soil.

Another granitic region shows itself to the south of the great limestone plain in Wicklow, where it forms the base of the mass of which that county is wholly composed, whence it extends into the mountainous ridge between Carlow and Wexford. The granite field is here bounded on each side by clay slate, which constitutes the greater part of the formation of the south-east and south of the country. The total absence of metallic veins on the western side of this granitic region, whilst they exist in abundance on the eastern, forms a singular feature of the district. The southern counties are chiefly a combination of clay slate and red sandstone, the latter showing itself mostly in the mountains. In the Slievebloom Mountains, between the King's and Queen's Counties, the sandstone bursts forth in the southern part of them from out of the clay slate in which it is imbedded. To the north of these mountains three insulated hills of sandstone rise out of the limestone plain, at Moat-a-Grenogue, Ballymahon, and Slieve Gouldry. The Galtees and Kilworth Mountains, in Cork, are of sandstone. In Kerry the clay slate predominates, till it is lost in the limestone which occupies its northern parts. In the west of Connaught the division between the limestone and granitic district is distinctly marked; a line from Galway to Oughterard designates their respective limits. All to the north, spreading over part of Mayo and Roscommon, is of the former; that to the south and west is of the latter formation.

The following table exhibits a general view of the geological features of the country, arranged according to the great natural regions into which it may be divided:—

Northern Region.

Mica Slate—Donegal; Londonderry, west; Tyrone.
Flœtz Trap—Londonderry, east; Antrim, north.
Sandstone—Mayo, east; Sligo; Roscommon; Leitrim, north; Fermanagh; Tyrone; Cavan, north; Monaghan, north; Armagh, north; Antrim, south.
Clay slate—Monaghan, south; Down; Louth; Longford, north; Cavan, south; Armagh, south.
Granite—Down, south.
Coal—Antrim, north; Tyrone; Roscommon; Leitrim.

Central Region.

Flœtz Limestone—Mayo, west; Leitrim, south; Longford, south; Westmeath; Meath; Galway, east; King's; Kildare, east; Dublin, north; Clare, west; Queen's;

Statistics.

Kilkenny, north; Carlow, west; Limerick, north; Kerry, north; Cork, north.

Sandstone in the mountain ridges—Mayo; Leitrim; Clare; King's; Queen's.

Clay Slate—Clare, east.

Granite—Galway, west.

Coal—Tipperary; Queen's; Kilkenny.

Southern Region.

Sandstone in the mountain ridges—Kerry, south; Limerick, south; Cork; Waterford; Kilkenny, south.

Clay slate—Kerry, south; Cork, south; Waterford; Wexford; Wicklow, east and west; Dublin, south.

Granite—Carlow, east; Wicklow, central.

Coal—Cork; Kerry.

Coal.

By the preceding table it will be seen that coal exists in each of the provinces; that in the two southern being carbonaceous or stone-coal, the slaty glantz-coal of Werner; that in the two northern provinces bituminous or blazing coal. The most productive mines are those of Leinster, which supply the surrounding country, and are conveyed by the canal to more distant parts. The Munster collieries are considered as of the greatest extent and richness, but their coal is less in demand, from the difficulty of conveyance, owing to the badness of the roads, and the rugged nature of the country in which they are lodged. The Tyrone coal is raised in quantities barely sufficient for the demand of the immediate neighbourhood. The Antrim collieries are scarcely worked. Those of Connaught labour under the inconveniences already pointed out respecting the collieries of Munster. The quantity supplied on the whole does not exclude the importation of British coal in large quantities, which is frequently preferred for culinary and domestic purposes, even in the vicinity of the native collieries.

The following table, showing that the demand for British coal increases with the increase of the population, is a proof that the quantity of native coal raised is every year less commensurate with the wants of the population.

Account of the Quantity of Coal sent to Ireland.

Years.	Tons.	Years.	Tons.
1819	669,060	1825	695,832
1820	606,400	1826	779,584
1821	644,787	1827	650,728
1822	694,024	1828	740,071
1823	693,413	1829	840,246
1824	691,429		

The scarcity of this valuable mineral is, however, amply compensated by the almost inexhaustible supply of peat fuel raised from the bogs in every part of the country.

Mines.

Notwithstanding repeated attempts, made at considerable expense, to work the metallic mines discovered in Ireland, few have been found sufficiently productive to repay the outlay of capital employed on them. Gold was discovered accidentally in the streams flowing from the mountain of Croghan Kinselagh, in the confines of Wicklow and Wexford. Several of the peasantry having enriched themselves by collecting it, the mine was taken possession of, and wrought under the directions of the government; but, after several years experience, the result was found to be inadequate to the expenditure, and the workings have been relinquished. The principal veins of copper and lead have been found on the eastern side of the granitic region of the county of Wicklow, the western being without any. The copper mines of Cronebane and Ballymurtagh were wrought with great effect for some years. They are now less productive. A mine at Bonmahon in Waterford, and another at Allihies in Cork, are worked with much spirit; but as, from the want of a sufficient supply of native coal, the ore has to be exported to Swansea to be smelted, the profit is much diminished. Mines of copper at Cappagh, at Kenmare and Ross Island in Kerry, and at Boulard in Galway, have all been relinquished in consequence of the failure of timber for fuel. Lead mines are more numerous and more productive. The principal are at Ballycorus, and Luganure in Wicklow, Kildrum in Donegal, Clea in Armagh, Came in Wexford, Castlemaine and Kenmare in Kerry, and Sheffry in Mayo. A rich vein of iron was worked at Arigna, near Lough Allen, until stopped from the failure of fuel. On the discovery of coal in the neighbourhood, the workings were resumed with a reasonable prospect of permanent profit; but this not having been fulfilled, the workings have been again abandoned. Antimony has been found at Castleshane, in Monaghan. Gypsum, fuller's earth, manganese, and ochres of various kinds, have been raised in many parts. Amethysts, chalcedony, and garnets, have also been found. Transparent crystals are met with frequently in Kerry. Several parts of Ireland produce marble, in much demand for domestic purposes. That of Kilkenny is of a deep black, mottled with white spots, evidently the exuviæ of marine shell-fish. The marble of Armagh is red, and less susceptible of polish. Galway contains several species; but the difficulty of conveying it through a mountainous district makes them little sought for.

Fossil.

The most remarkable fossil remains are those of the Elk or Moosedeer, celebrated for the great size of the horns, one pair of which measured ten feet ten inches from tip to tip. A complete skeleton of this noble animal has not yet been found; but a fine specimen, comprising most of the bones, is preserved in the museum of Trinity College, Dublin. Mineral springs are numerous, most of them are chalybeate. Those of chief note for their medicinal qualities are Mallow in Cork, resembling the hot wells in Bristol; Ballynahinch in Down, and Golden bridge near Dublin, sulphureous and chalybeate; Swadlinbar in Cavan, and Lucan in Dublin, sulphureous; and Castleconnel near Limerick, chalybeate.

Soil.

The prevalent soil is a fertile loam, resting on a rocky substratum, chiefly of limestone. The depth, though in general not great, is in some parts such as to admit of fresh vegetable mould being repeatedly thrown up by successive ploughings to a greater depth. This occurrence is most striking in Meath, and in the district of the counties of Tipperary and Limerick, long distinguished by the name of the Golden Vale, from its extraordinary fertility. In some parts, particularly in Galway, the rock shows itself above the surface in ridges like waves, the interstices being filled with rich mould, which produces a thick, close sward, extremely grateful to sheep. Large tracts of grazing land similar to the Downs in England are unusual; the only tract of any extent of such description is the Curragh of Kildare, which has been used, time immemorial, for a sheep walk. The mountains are capable of tillage to a considerable height; and their summits, with the exception of a few of the very highest, are fit for pasturage in summer.

Climate.

The moisture of the climate, caused by the insular position of the country, and the prevalence of western and southern winds, contributes its full share to the peculiar adaptation of the soil for pasturage, insomuch so that its perennial verdure has justly acquired it the poetical title of the Emerald Isle. Neither does this peculiarity of climate, which tends so powerfully to the increase of the agricultural wealth of the country, detract from its salubrity, as is apparent from the comparative ratios of length of life in Great Britain and Ireland; the proportion of persons above an hundred years of age being in the former as ·1 to 10,000, whilst in the latter it is as ·5 to the same quantity. The same proportion applied to the several provinces of Iretistics. land, proves that the province of Connaught, confessedly the most moist in climate, is also the most favourable to the duration of human life. The ratios are as follow :—

Leinster	·5 to 10,000
Ulster	·3 to 10,000
Munster	·5 to 10,000
Connaught	·9 to 10,000

The same peculiarity of climate serves to account for the absence of venomous reptiles. Snakes are unknown, as are toads, unless, as is asserted by some zoologists, they are to be seen occasionally in parts of Kerry, where they are said to be distinguished by the name of creeping frogs. Even this latter animal is not aboriginal. Its introduction is no earlier than the last century, when, after the living animal had been imported without success, it was afterwards propagated by means of spawn.

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Previously to the calculations made by Sir William Petty to ascertain the numbers of the inhabitants of Ireland, scarcely any data, even for a probable or conjectural estimate, existed. The marks of the plough observable on the tops of hills which have for many years been devoted to pasture only, have been adduced as a proof that the superabundant population of former ages compelled the farmers to have recourse to the poorer ground there to raise a sufficiency of grain; but the fact has been imputed, with equal show of probability, to the disturbed state of the country, when a ferocious enemy, having desolated and possessed the more fertile lands in the plains, compelled the natives to have recourse to the poorer soils on the hills. It has also been attributed by some to the superior mildness of the climate in ancient times. The opinion of Agricola, quoted by Tacitus, that a single legion would be sufficient to conquer the island, does not indicate a very numerous population at that period; and, subsequently, the smallness of the force which enabled Henry II. to make such an impression on the country favours the same conclusion. After the close of the desolating wars of Elizabeth, in which the Irish in arms were generally exterminated as rebels, Fynes Moryson, Lord Mountjoy's secretary, asserts that not more than five or six hundred thousand escaped the edge of the sword or the horrors of famine. Sir William Petty's first estimate, as stated in the ensuing table, rests upon conjecture; his second is founded on the number of "smokes" or hearths in the country. Those given by the tax-collectors are founded on data of the same description, corrected in the case of Mr Bushe by collateral calculations. The returns of the established clergy were made at a time in which much of the country was without a resident clergy of this persuasion, and therefore must be of doubtful weight. De Burgho's, formed from information collected through the Catholic clergy, then in a state of the lowest political degradation, must be equally dubious. Newenham formed his from a great variety of ingenious calculations on the quantity of food, exports, and imports, and other similar circumstances. The first of the parliamentary inquiries was a total failure, several counties having declined to make any return, and those of several others being glaringly deficient and inaccurate. The second, Statistics. which ascertained not only the number, but the name, age, occupation, and degree of mutual relationship, of every inhabitant, particulars which still exist in the archives of Dublin Castle as a permanent record of the facts, may be considered as approximating very closely to accuracy. In the third, which might be presumed to be an improvement on the preceding in these respects, the returns of the enumerators employed were not subjected, as in the preceding instance, to any effectual check, and therefore little reliance can be placed on its statements. The returns of occupations in the city of Dublin, where their accuracy can be easily ascertained, are extremely faulty. The latest return of the population, that of 1834, rests on the same defective basis as that of 1831; but as it was afterwards checked and corrected by the commissioners of public instruction, through the medium of the resident clergy, its statements are entitled to more credit. Unhappily for statistical and political purposes, the returns of this last census have been made according to the ecclesiastical arrangement of dioceses, which it is nearly impossible to reduce to that of counties, on which all the former returns had been formed. According to these documents, it appears, that from 1672 to 1723, a period of fifty years, the population had nearly doubled. In the next fifty years, from 1723 to 1777, it had advanced more slowly; and, from 1777 to 1831, somewhat more than fifty years, it had nearly trebled, the period of doubling, from 1777 to 1805, if Newenham's calculation be correct, being but twenty-eight years.

Population of Ireland at different periods.

1652	Sir William Petty	850,000
1672	Ditto	1,320,000
1695	Captain South	1,034,102
1712	Thomas Dobbs	2,099,094
1718	Ditto	2,169,048
1723	Ditto	2,317,374
1726	Ditto	2,309,106
1731	Established Clergy	2,010,221
1754	Tax Collectors	2,372,634
1760	De Burgho, Hibern. Dominican	2,317,384
1767	Tax Collectors	2,544,276
1777	Ditto	2,690,556
1785	Ditto	2,845,932
1788	Gervais P. Bushe	4,040,000
1791	Tax Collectors	4,206,612
1792	Dr Beaufort	4,088,226
1805	Thomas Newenham	5,395,456
1811	Parliamentary Return	5,937,856
1821	Ditto	6,801,827
1831	Ditto	7,734,365
1834	Commissioners of Public Instruction	7,943,940

The following table contains the summaries of the three parliamentary returns according to counties, that of 1834 being omitted for the reason already stated.

Population by Counties.

	Order according to Surface.	Order according to Total Population.	Order according to Density of Population.	Total Population. 1813.	Total Population. 1821.	Total Population. 1831.	Ratio of Increase from 1821 to 1831.	Ratio of Population to total number of Acres.[1]	Ratio of Population to the number of cultivable Acres.[1]
Carlow	31	32	17	69,566	78,952	81,576	3	2·69	2·42
Dublin	30	4	5	110,437	150,011	183,042	22		
Dublin, city	...	...	...	176,610	185,881	203,652	9½	1·31	1·25
Kildare	25	31	27	85,138	99,065	108,401	9½	3·62	3·00
Kilkenny	17	17	13	134,664	158,716	169,283	6¾	2·96	2·33
Kilkenny, city	...	...	...	...	23,230	23,741	2¼	...	...
King's	15	24	24	113,226	131,088	144,029	9¾	3·66	2·74
Longford	29	30	6	95,917	107,570	112,391	4½	2·34	1·71
Louth	32	28	2	...	101,011	108,168	7	1·85	1·69
Drogheda, tn.	...	...	...	16,123	18,118	17,365	...	...	...
Meath	13	20	23	142,479	159,183	177,023	11	3·20	3·17
Queen's	24	23	18	113,857	134,275	145,843	8¾	2·72	2·30
Westmeath	26	26	20	...	128,819	136,799	6¼	2·82	2·30
Wexford	14	19	21	...	170,806	182,991	7	5·08	2·95
Wicklow	18	29	30	83,109	110,767	122,301	9	4·04	3·27
LEINSTER	...	...	...	...	1,757,492	1,927,967	9	2·48	2·13
Clare	7	13	26	160,603	208,089	258,262	24	3·10	2·03
Cork	1	1	9	523,936	629,786	705,926	10	2·44	1·45
Cork, city	...	...	...	64,394	100,658	107,041	6		
Kerry	5	11	32	178,622	216,185	264,559	22	4·34	2·19
Limerick	...	7	7	103,865	218,432	233,505	7	2·88	2·25
Limerick, city	...	...	...	...	59,045	66,575	13	...	...
Tipperary	6	2	12	290,531	346,896	402,598	16	2·51	2·03
Waterford	...	21	15	119,457	127,842	148,077	16	3·12	2·99
Waterford, city	...	...	...	25,467	28,679	28,821	...	...	...
MUNSTER	...	...	...	...	1,935,612	2,215,364	14	2·65	1·76
Antrim	8	8	8	231,548	262,860	314,608	20	2·41	1·48
Carrickfergus, town	...	...	...	6,136	8,023	8,698	8	...	...
Armagh	27	14	1	121,449	197,427	220,651	11½	1·44	1·21
Cavan	19	15	10	...	195,076	228,050	17	2·07	1·85
Donegal	4	10	29	...	248,270	298,104	20	3·91	1·07
Down	11	5	4	287,290	325,410	352,571	8½	1·73	1·42
Fermanagh	20	25	25	111,250	130,997	149,555	14	3·15	2·14
Londonderry	16	16	11	186,181	193,869	222,416	15	2·12	1·67
Monaghan	28	18	3	140,433	174,697	195,532	12	1·67	1·58
Tyrone	9	9	19	250,746	261,865	302,943	15½	2·12	1·83
ULSTER	...	...	...	...	1,998,494	2,293,128	14	2·36	1·63
Galway	2	3	31	140,995	309,599	394,287	27¼	3·78	2·40
Galway, town	...	...	...	24,684	27,775	33,120	19	...	...
Leitrim	23	27	22	94,095	124,785	141,303	13	2·97	1·88
Mayo	3	6	28	237,371	293,112	367,956	25½	3·63	2·37
Roscommon	12	12	14	158,110	208,729	239,903	15	2·54	1·89
Sligo	22	22	16	...	146,129	171,508	18	2·53	1·49
CONNAUGHT	...	...	...	...	1,110,229	1,348,977	22	3·28	2·07
IRELAND	...	...	...	...	6,801,827	7,784,536	14	2·69	1·89

[1] The population or extent in acres of the counties of cities and towns is not included in these calculations of ratios.

Statistics.

The returns of 1821 give a general average of five and three-fourth souls to a family. The defective state of parish registers in a country in which these documents are kept by three classes of clergymen, each observing a system of arrangement peculiar to themselves, prevents any authoritative deductions from that source as to the question of the duration of human life. But the following table, taken from the parliamentary return of 1821, on which reliance may be placed, furnishes the ratio of ages to every 10,000 of the total population at that period. The statement of ages in the late census of 1831 is still less worthy of credit than that of the numbers.

Statement of the comparative duration of Human Life, according to a ratio of Ages to every 10,000 *of the Population of* 1821.

Age.	Leinster.	Ulster.	Munster.	Connaught.	Ireland.	Age.	Leinster.	Ulster.	Munster.	Connaught.	Ireland.
Under 5	15·070	14·800	15·600	16·140	15·320	50 to 60	6·090	6·160	5·830	5·930	6·000
5 to 10	13·000	13·190	14·070	14·190	13·550	60 to 70	2·780	3·300	2·350	2·280	2·730
10 to 15	11·890	12·480	12·160	12·180	12·180	70 to 80	945	1·230	787	770	960
15 to 20	11·440	12·530	12·340	12·500	12·190	80 to 90	206	290	140	96	230
20 to 30	18·630	17·190	17·350	17·110	17·600	90 to 100	34	30	23	28	30
30 to 40	11·760	10·800	11·970	11·590	11·500	Above 100	3	5	5	9	5
40 to 50	8·140	7·980	7·363	7·200	7·710						

Divisions.

The most ancient annals record a twofold division of the country by two of the descendants of Milesius, who made a line drawn from Dublin to Galway the boundary of their respective shares; of these the northern was called Leath Conn, the southern Leath Mogha. In the time of Ptolemy the island was partitioned out by a number of tribes, whose position has been determined by Whitaker as follows:—

Name according to		Modern County.	Boundary.	
Whitaker.	Ptolemy.		From	To
NORTH.				
Robogdii	Ροϐογδιοι	Londonderry, Antrim	Hornhead	Fairhead
EAST.				
Damnii	Δαϐνοι	Antrim, Down	Fairhead	Ardglas
Voluntii	Ουολουντιοι	Down, Armagh, Louth	Ardglas	Boyne River
Eblani	'Εϐλανοι	Meath, Dublin	Boyne River	Læbius or Liffey River
Caucii	Καυκοι	Dublin, Wicklow	Liffey River	Oboca or Ovoca
Menapii	Μαναπιοι	Wicklow, Wexford	Oboca	Carnsore Point
Coriundi	Κοϱιονδιοι	Wicklow, Kildare, Carlow	Between the Boyne and Barrow Rivers, the Eblani, and the Brigantes.	
SOUTH.				
Brigantes	Βϱιγαντες	Wexford, Waterford	Carnsore	Blackwater River
Vodii	'Ουοδιοι	Cork	Blackwater	Bann River
Ibernii	'Ουτεϱνοι	Cork, Kerry	Bann	Ibernus or Dingle Bay
WEST.				
Luceni	......	Kerry	Dingle Bay	......
Velaborii	'Ουελιϐοϱοι	Kerry, Limerick	......	Senus or Shannon River
Cangani	Γαγγανοι	Clare	.....	......
Auterii	'Αυτεϱοι	Galway	Galway Bay	Libnius River
Nagnatæ	Ναγναται	Mayo, Sligo, Roscommon, Leitrim, Fermanagh	Libnius	Rhebius or Ballyshannon River
Hardinii	'Εϱδινοι	Donegal	Ballyshannon	Hornhead
CENTRAL.				
Scoti	......	Tyrone, Fermanagh, Leitrim, Monaghan, Cavan, Longford, Westmeath, King's, Queen's, Kilkenny, Tipperary	Bounded by the Shannon, Loughs Allen and Erne, west; Barrow, Boyne, and Lough Neagh, east; Suir and Blackwater south; and a chain of mountains north.	

A subsequent division was that into the five petty kingdoms of Leinster, Ulster, Munster, Connaught, and Meath, which last consisted of the counties of Meath, Westmeath, Longford, and parts of Armagh and Louth. This division

Statistics.

existed till after the arrival of the English, when, in the reign of John, the parts subject to his sway were formed into the twelve counties of Dublin, Meath, Kildare, Uriel (now Louth), Carlow, Kilkenny, Wexford, Waterford, Cork, Kerry, Limerick, and Tipperary. No further change took place until the reign of Philip and Mary, when the King's and Queen's Counties were formed. Elizabeth divided Connaught into the seven counties of Galway, Clare, Roscommon, Mayo, Sligo, Leitrim, and Longford; and Ulster into the nine counties of which it consists at present. Wicklow was separated from Dublin, and made a distinct county, by James I. The only alteration which has occurred since, is the transfer of some of the counties of Connaught into the adjoining provinces, and the division of the county of Cork into two parts, called the East and West Ridings. This latter division took place in 1823. An act, passed in 1835, gives the lord-lieutenant a discretionary power of subdividing the larger counties, as has already been done with respect to Cork. The topographical arrangement of Ireland, given by Camden in his *Britannia*, retains the pentarchical division. It is as follows:—

Munster, including Kerry, Desmond (now incorporated into Cork and Kerry), Waterford, Limerick, Tipperary, with the county of Tipperary Holycross; *Leinster*, including Kilkenny, Caterlough (now Carlow), Queen's, King's, Kildare, Weishford, Dublin; *Meath*, including Eastmeath, Westmeath, Longford; *Connaught*, including Twomund (now Clare), Galloway, Maio, Slego, Letrim; and *Ulster*, including Louth, Cavon, Fermanagh, Monaghan, Armagh, Down, Antrim, Colrane (now Londonderry), Tir-oen, Tirconnell or Donegall.

The counties are subdivided into baronies, the baronies into parishes, and these again into townlands or ploughlands, which is the name of the smallest territorial subdivision. Besides the thirty-two counties already named, a few cities and towns, with a small surrounding portion of land, form separate jurisdictions under their own magistrates, and are also called counties. There are eight of them; five cities, Dublin, Cork, Limerick, Waterford, and Kilkenny, and three towns, Galway, Drogheda, and Carrickfergus. The territorial divisions of the country, according to the civil arrangement of it, are as follow:

Provinces.	Counties at Large.	Counties of Cities or Towns.	Baronies.	Parishes.	Parts of Parishes.
Leinster....	12	3	115	830	75
Ulster......	9	1	68	311	51
Munster....	6	3	68	708	50
Connaught	5	1	44	276	22
Total...	32	8	295	2125	198

Ecclesiastical divisions.

Established church.

The ecclesiastical arrangement of the country was, until lately, framed on the same fourfold provincial division as the civil, but under different names and with different boundaries. There were four archbishoprics, one for each province; but named from the place in which the archiepiscopal see was fixed. The number of bishoprics subject to each of these varied at different periods, and two or more sees were frequently united to afford a revenue competent to maintain the dignity of the holder. Formerly the dioceses were much more numerous than at present, as may be seen from the following list, taken from an old Roman Provincial, and given nearly in the words of the original.

Armagh, containing Meath or Elnamirand, Down or Dundalethglass, Clogher or Lugundun, Connor, Ardachad (Ardagh), Rathbot (Raphoe), Rathlue (now part of Derry), Daln-liquir (unknown, but by some supposed to have merged into Meath), Dearri (Derry); *Dublin*, containing Glendelagh, Fern, Ossori or De-Canic, Lechlin, Kildare or Dare; *Cassel*, containing Isle of Gatha (now Innis-Scattery, and united to Limerick), Limric, Laon or De Kendalnan (now Killaloe), Cellumabrath (called also Fenebore, now Kilfenora), Melie or Emileth (Emly), Ross or Roscrea, Waterford or Baltifordian, Lismore, Clone or Cluanan (Cloyne), Cork, Rosalither (now part of Cork), Ardforth; *Tuam*, containing Duac or Kilmacduach, Mage (or Mayo, now part of Tuam), Enachdun (also part of Tuam), Cellaiar (unknown), Roscommon (translated to Elphin), Clonfert, Achad (Achonry), Lade or Killaleth (Killala), Conani (Clonmacnois, now part of Meath), Kilmunduach (Kilmacduagh), Elphin.

The modern division, until the alterations made since the reform act, is as follows:—

List of the archbishops and bishops of Ireland, according to the ecclesiastical provinces as they were arranged previously to the act for the reduction of ten bishoprics, with the amount of their respective incomes. Those marked with an asterisk are the bishoprics to be reduced under the act. Those in Italics are already united each with another see, according to its provisions.

ARMAGH	L.17,669	16	7
Meath and Clonmacnois	5,220	10	6
* Clogher	10,371	0	2
Down and Connor	5,896	0	1
Derry	14,193	3	9½
* *Raphoe*	5,787	8	2
Kilmore	7,477	17	0½
* Dromore	4,813	6	9
DUBLIN and Glandclagh	9,320	12	9
* Kildare and Christ-Church Deanry	6,451	13	3
* *Ossory*	3,859	0	6¾
Ferns and Leighlin	6,550	2	10
CASHEL and Emly	7,354	2	0
Limerick, Ardfert, and Aghadoe	5,368	13	5
* *Waterford* and *Lismore*	4,323	7	1
* *Cork* and *Ross*	4,345	18	9¾
Cloyne	5,008	18	10¼
TUAM and Ardagh	8,206	3	9¾
* Elphin	7,034	8	9
* *Clonfert* and *Kilmacduagh*	3,260	19	4¾
* *Killala* and *Achonry*	4,081	18	8
Total	L.151,127	12	4¼

By the new ecclesiastical arrangement there are to be but two archbishoprics, Armagh and Dublin, the two others being reduced to the rank of bishoprics. The bishoprics are also to be consolidated under twelve bishops, instead of eighteen, as heretofore. The arrangement, when completed by the falling in of the several sees on the demise of their present incumbents, will stand as follows:—

Archbishops and Bishops since the Reduction, with their respective Incomes.

ARMAGH, with Clogher	L.13,170
Meath	5,221
Derry, with Raphoe	8,033
Down, with Connor and Dromore	5,896
Kilmore, with Ardagh and Elphin	7,478
Tuam, with Killala and Achonry	5,020
DUBLIN, with Glandclagh and Kildare	9,321
Ossory, with Leighlin and Ferns	6,550
Cashel, with Emly, Waterford, and Lismore	7,354
Cloyne, with Cork and Ross	5,009
Killaloe, with Kilfenora, Clonfert, and Kilmacduagh	4,532
Limerick, with Ardfert and Aghadoe	5,369
	L.82,953

Statistics.

The other dignitaries of the establishment are thirty-three deans, twenty-six precentors, twenty-two chancellors, twenty-one treasurers, thirty-four archdeacons, two provosts, and one sacristan, besides which there are 178 prebendaries and nine canons. Of these, forty-two of the dignitaries and fifty-two prebendaries are sinecurists, or nearly so, requiring only an occasional attendance at the cathedral church; the remainder derive their incomes from benefices with cure of souls, and may therefore be considered as parochial clergy. There are likewise some subordinate corporations, consisting of five canons, fifty-nine vicars-choral, and fifteen choiristers, in twelve of the cathedral churches. The number and names of parishes, according to the ecclesiastical arrangement by which the clerical duties are performed and the tithes collected, vary considerably from the civil arrangement according to which the county assessments are levied. The latest returns state the number of parishes at 2348, which are condensed into 1385 benefices, each under a separate incumbent, who enjoys the emoluments, as follows:—

Statement of the Number of Parishes and Benefices.

Provinces.	BENEFICES, CONSISTING OF			TOTAL OF	
	A Single Parish, or Part of One.	Two or more Contiguous.	Parishes or Parts not Contiguous	Benefices.	Parishes.
Armagh	396	90	16	502	658
Dublin	174	115	22	311	624
Cashel	301	132	36	469	791
Tuam	36	54	13	103	275
Ireland	907	391	87	1385	2348

The income by which the whole establishment is maintained, is as follows:—

Archbishops and bishops	L.151,128
Deans and chapters	1,043
Economy estates of cathedrals	11,056
Subordinate ecclesiastical corporations	10,526
Dignities and prebends without cure of souls, and exclusive of those held by bishops	34,482
Glebe lands	92,000
Tithes	555,000
Minister's money	10,300
	L.865,535

The population for whose spiritual benefit this extensive and complicated structure of ecclesiastical jurisdictions is maintained, is thus distributed among the several sects, according to the late returns of the commissioners of public instruction, as shown by the following table, which exhibits also the proportion per cent. borne by the several religious denominations to the total population:—

Denomination.	Total Population.	Proportion per cent.
Established church	852,064	10·726
Roman Catholics	6,427,712	80·913
Presbyterians	642,356	8·086
Other dissenters	21,808	0·275
Total population	7,943,940	100·000

By referring to the amount already stated as being the income of the established church, it will appear, that whilst the Roman Catholics provide for the total maintenance of their clergy by voluntary contribution from amongst themselves, the religious instruction of the Protestant portion of the population costs the country two shillings per head annually; or, in other words, every family has to contribute nearly twelve shillings a year towards the maintenance of the established clergy; whereas, if that body were to derive its support solely from the contributions of its own members, as is the case with the Roman Catholic clergy, the sum to be annually paid by every Protestant, man, woman, and child, in order to make up the sum of L.865,000 deemed necessary for the maintenance of their establishment, would be one pound each, or six pounds for every family.

Roman Catholic church.

The hierarchy of the Roman Catholic church still continues of the same form that it bore previously to the Reformation, consisting of four archbishops and twenty-two bishops, to which another has been lately added; the town and vicinity of Galway, which had been hitherto an exempt jurisdiction under an ecclesiastical head styled warden, having been erected into a see. The hierarchy is supported by the profits of some one or more parishes in the respective dioceses, by fees from the incumbents of the others, and by those of marriage licenses. The incomes of the bishops, as well as those of every class of Catholic clergy, are derived wholly from voluntary contributions. Monasteries and convents are numerous, and some, particularly those for females, are well endowed.

Presbyterian church.

The presbyterian church, which flourishes chiefly in the north of Ireland, is governed by a synod, which chooses a moderator annually as its president. The ministers are maintained partly by the voluntary contributions of their respective congregations, and partly by an annual parliamentary grant called the Regium Donum.

Representation.

Ireland is represented in the imperial legislature by twenty-eight temporal and four spiritual peers, and 105 commoners. The temporal peers hold their seats for life; the spiritual peers sit annually, according to a rotation of sees. The changes in the right of franchise for the election of commoners have been very considerable since the passing of the Catholic relief bill, which diminished the number of electors in an extraordinary degree. The following table shows the alterations caused by the legislative measures adopted since the passing of that act, as compared with the previous state of the constituency. The first line gives the average number of electors before 1829. The other lines show the effects since produced by subsequent acts of parliament.

Constituency.

Year.	L.100.	L.50.	L.20.	L.10.	40s.	Total.
1829,	303	18,066	6806	...	191,606	216,791
1830,	98	17,409	7319	11,804	...	39,772
1832,	31	10,214	8414	42,066	...	60,725

Government.

The executive government is committed to a lord-lieutenant deputed by the crown. He holds his place during pleasure, but is generally continued in office for five years. He is assisted by the privy council, a body also nominated by the king, and invested with extensive powers, as well judicial as ministerial; also by a chief secretary, who is a member of the House of Commons, and is the person looked to by the legislature for the management of the country. Each county is also placed under a lord-lieutenant nominated by the crown, who is considered to be responsible for the preservation of good order, and has much weight in the nomination of the magistrates. He is aided by a number of deputy lieutenants, also nominated by the crown.

The levy and expenditure of money for local purposes is in the hands of the grand juries in every county; the members are named annually by the high sheriff, from among the chief landed proprietors or their agents. This arrangement has given rise to much abuse in the management of the funds intrusted to them. The sums levied bear very heavily on the industry of the actual landholder; and the application of them is subject to strong imputations, often too well founded, of fraud and favouritism.

Law.

The administration of law is vested in the lord chancellor, who is assisted by the master of the rolls, and in the twelve judges of the supreme courts, namely, the King's Bench, Common Pleas, and Exchequer. The judges visit the counties twice a year, in six circuits, for the decision of weightier causes, and the investigation of heavy offences. Minor cases are brought before the magistrates at petty sessions, who are then assisted by a lawyer nominated by the crown, under the name of assistant barrister.

Military.

A very numerous armed force has long been maintained in Ireland. Regular troops, to the number of from twenty to twenty-five thousand men, are quartered in barracks in all parts; besides which, a well-armed and organized body of police, amounting to nearly 6000 effective men, is maintained. These are placed under the immediate control of stipendiary or salaried magistrates, appointed by the crown. In addition to the military and police, a force of armed yeomanry, mostly Protestant, was supported until lately, and called out occasionally into active service.

Revenue.

Before the arrival of the English, the revenues of Ireland were paid in cattle; and even after that period the custom prevailed for several centuries in the parts less subject to foreign influence. Traces of it have been met with so late as the reign of Elizabeth. The new government, under the English, introduced the method of raising money by subsidies. John exacted a subsidy from the Irish clergy, and established the court of exchequer for the general management of the revenue. The same method was continued during the reigns of Henry III. and the first Edwards; but the income thus extracted from the people proved so inadequate to meet the wasteful expenditure caused by a repetition of foreign wars and intestine commotions, that recourse was had to the legalized extortion of coygne and livery, which was the levying of man's meat and horse's meat for the soldiery in time of service. The amount of the regular revenue, in the reign of Edward III., is stated by Walsingham and Holingshead to have been L.30,000; but Sir John Davis, who collected his information from the pipe-rolls, and other authentic sources, reduces it to L.10,000. The most remarkable financial measure of Richard II. was a tax upon absentees. In 1433, the eleventh of Henry VI., the revenue was reduced to L.2339. 18s. 6d., whilst the expenses of the government were L.2348. 16s. 11½d., thus exceeding the income by L.18. 17s. 5½d. At the latter end of the same reign, the Duke of York, when sent over as lord-lieutenant with extraordinary powers, not only obtained the whole revenue, but stipulated for an additional supply from England of 4000 marks for the first year, and L.2000 for every year thereafter. Edward IV. raised money by the imposition of duties on all merchandise sold in Ireland except hides. In the fifteenth year of Henry VII. a duty of one shilling in the pound was laid on all merchandise imported and exported, except wine and oil; and a tax, by way of subsidy, of 13s. 4d. on every hide of land. During this reign the revenue seldom exceeded L.5000. During the reign of Henry VIII. the revenue was increased by the suppression of monasteries. The laws against absentees were also enforced. During the first fifteen years of Elizabeth, the revenue was L.120,000, or L.8000 per annum, according to Ware, though Sinclair states it at only L.6000, whilst the expenses amounted to L.490,779. 7s. 6½d. In 1599, at the close of Tyrone's rebellion, L.600,000 were spent in six months; and Sir Robert Cecil affirmed that Ireland had cost the queen L.3,400,000 in ten years' time. The pacific reign of James tended much to the improvement of the revenue. The customs increased from L.50 to L.3000, and at the close of his reign to L.9700. The wardships and other feudal rights produced about L.10,000, notwithstanding which the income was inadequate to the expenditure. To defray the expense of the army, an order of baronets was established, by which L.98,500 was raised, in addition to which L.247,433 were remitted from England to clear off the debts incurred by Elizabeth. The Irish parliament granted the same king a subsidy of 2s. 8d. in the pound on every personal estate of three pounds annual value, and fourpence in the pound on every real estate of one pound value; an act of liberality with which James was so much pleased, that he declared "he would hereafter hold his Irish subjects in equal favour with those of his other kingdoms." In the succeeding reign Strafford raised the customs to four times their previous amount. In the same reign the first mention is made of an excise tax. The distractions of the country till the restoration afforded little means to ascertain the progress of the revenue. Thurloe, however, in his state papers, mentions that the revenue for two years ending in 1657 amounted to L.137,558. 13s. 3d., whilst the expenditure was L.142,509. 11s., leaving a deficit of L.4959. 17s. 9d. When the Irish parliament met after the restoration, it granted, first, an hereditary revenue to the king, his heirs and successors; second, an excise for maintaining the army; third, the subsidy of tonnage and poundage for the navy; and, fourth, a tax of two shillings each on hearths, in lieu of the feudal burdens, which were then abolished. After the revolution, the information respecting this important element of national statistics becomes more precise and satisfactory. The revenue, from the landing of Schomberg in 1689 till the end of the reign of William, was as follows, the total of the previous military expenditure of the war with James having amounted to L.3,851,655:

1689	L.8,834	1696	L.513,534
1690	93,910	1697	548,967
1691	274,949	1698	601,846
1692	393,926	1699	701,932
1693	444,183	1700	766,620
1694	430,534	1701	697,955
1695	438,304	1702	581,286

During the earlier part of Anne's reign the income exceeded half a million, but in her latter days it was less productive. In the reign of George I. the state of the revenue continued nearly as in the preceding reign. In that of George II. there was a surplus, which was applied, not always judiciously, to public works.

From the earlier part of the reign of George III. to the present period, the total amount of the public income was formed of the customs, excise, land tax, assessed taxes, stamps, postage, duties on pensions and offices, lotteries, and poundage pells and casualties. Up to 1811 the first four of these make but a single item in the parliamentary account. After that date the customs are specified as a separate item. The Irish lottery ceased at the union; the land tax at the consolidation of the exchequers in 1817;

istics. the assessed taxes were repealed in 1822–23, since which time the whole income is formed of the items of customs, excise, stamps, postage, and poundage and casualties. The following table, exhibiting the receipts for every fifth year, from 1790 to 1830, will give a general view of the progress of taxation in its leading departments during that period. Statistics.

Account of the Receipt of the Revenues of Ireland for every Fifth Year from the 5th of January 1790, *to the 5th of January* 1830, *arranged under the several Heads of Collection.*

	Customs.	Excise.	Land Tax.	Assessed Taxes.	Stamps.	Postage.	Pensions, &c.	Lotteries.	Poundage, &c.
	L.				L.	L.	L.	L.	L.
1795	1,031,035	The Excise, Land Tax, and Assessed Taxes, are included in the preceding item of Customs.			67,560	15,973	12,642	1,002	51,362
1800	2,335,034				122,001	17,150	7,865	62,546	36,196
1805	2,622,268				316,527	38,893	...	...	38,642
		L.							
1810	2,281,609	1,014,887	The Land and Assessed Taxes are included in the preceding item of Excise.		569,678	53,050	...	...	32,102
1815	1,737,512	2,598,049		L.	645,578	82,154	...	...	41,411
1820	1,514,260	1,707,151	...	280,607	482,470	53,538	...	...	10,561
1825	1,087,999	1,654,756	...	...	490,945	76,615	...	...	9,749
1830	1,187,978	1,790,288	...	...	456,669	105,000	...	...	8,887
1835	1,744,764	1,966,531	...	...	470,286	215,374	...	...	3,998

The expenditure for every fifth year corresponding with the years in the preceding table is given in that which follows. The first item states the payments of interest and management of the public funded debt; the second, the payments out of the consolidated fund, which include the civil list, miscellaneous payments, and interest on Irish treasury bills; and then follow the charges for the army, the navy, and the miscellaneous expenditure. The last column consists chiefly of advances for the relief of trade, and other public objects.

Table of the Public Expenditure for every Fifth Year from 1790 *to* 1830.

	Dividends.	Consolidated Fund.	Army.	Navy.	Ordnance.	Miscellaneous.	Relief of Trade, &c.
	L.	L.	L.	L.	L.	L.	L.
1795	149,949	282,830	1,360,663	...	138,756	321,301	...
1800	926,695	491,802	3,528,801	21,126	350,769	395,443	...
1805	1,702,871	510,631	3,627,223	...	486,541	349,144	823
1810	2,437,803	425,220	3,372,662	...	633,202	394,770	22,673
1815	3,460,447	550,901	2,782,995	...	404,186	643,173	80,542
1820	1,026,650	503,638	1,377,259	...	129,219	374,943	153,483
1825	1,008,988	507,101	1,019,279	...	234,785	436,713	327,411
1830	1,178,454	584,969	986,209	...	...	366,872	380,817

The national debt of Ireland, incurred by an excess of expenditure beyond the income of the country, increased with great rapidity towards the close of the last century and till the year 1817, when it ceased to form a separate item in the public accounts, in consequence of the consolidation of the British and Irish exchequers. Its progressive increase since the revolution is exhibited in the following table.

Public Debt of Ireland.

1716	L.16,106	1770	L.628,883
1720	87,511	1780	1,067,565
1730	220,730	1790	1,586,067
1740	296,988	1800	22,245,190
1750	205,117	1810	75,240,790
1762	223,438	1817	134,602,769

urces of venue. Ireland has, till of late years, been almost exclusively a pastoral country. The population drew its chief sustenance from cattle, and the few manufactures were derived from the same source.

oollens. The rich pasturages, adapted both for black cattle and sheep, furnished in abundance the material for two branches; the woollen trade, and the tanning of leather. The former was carried on to a considerable extent at a very remote period. Traces of an export of woollens to Italy as early as the reign of Edward III. have been discovered. The manufacture was an object of legislative interference as early as the third year of Edward IV. (1462); and an act of Henry VIII. in 1542 expressly notices the exportation of woollen yarn from Ireland. The former of these acts was the first attempt to restrict the importation of foreign goods into England, to the prejudice of the native artist. By it woollens, laces, and ribbons were prohibited; but a provision was inserted, "that all wares and chaffers made in the land of Ireland may be brought and sold in this land of England, as they were wont to do before the making of this statute." Although subsequent prohibitory acts of Elizabeth, James, and Charles I. make no mention of Ireland, there is little reason to suppose that any change was made as to the freedom of trade with this country, until the 12th of Charles II., when an act was passed in the English parliament, imposing such rates of duty as effectually prevented importation. By an act of the same year, the exportation of wool from England was prohibited generally, as was that from Ireland, to foreign countries. An act of the 9th and 10th of William III. prohibited the exportation of fullers' earth to Ireland. But the great blow to this branch of national industry was caused by an address from both houses of the English parliament to William in 1698, praying him, "with a view to secure the

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woollen manufacture as much as possible entire to England, that he would use his utmost diligence to hinder the exportation of wool from Ireland, except to be imported hither; and for discouraging the woollen and encouraging the linen manufactures of Ireland." The immediate consequence of these addresses was the passing of an act prohibiting the exportation of wool or woollens, except to England, from which country the manufactured article was already excluded by the act of the 12th Charles II., still in force. Under this code England effectually restrained the Irish trade. The supply of the raw material was narrowed by the impossibility of importing British wool, and the manufactured goods were confined to the domestic consumption of the country. Scarcely a vestige of this ill-advised system now exists. The laws which prohibited the exportation of Irish woollens to foreign countries, and to the British colonies, were repealed in 1779. By the act of union, the duties on woollens imported into either island were confined to those called "old and new draperies;" and the high duties of Charles II. were reduced to eightpence halfpenny per yard on the old, and twopence three farthings on the new draperies. By the same act, England relaxed her monopoly so far as to permit the export of wool and woollen yarn duty free to Ireland. According to evidence before the House of Commons in 1832, one third of the cloth used in Ireland is brought from Great Britain; but as that imported is usually of finer quality, the value of it is estimated at one half. The manufacture of Ireland is confined to the coarsest description of goods; every attempt to introduce the manufacture of the higher-priced articles has been the cause of the ruin of the speculator who ventured upon it. Broad cloths and blanket manufactories exist nowhere north of Dublin; flannels are made in Wicklow, and blankets in Kilkenny. Frize of the coarsest kind is made in most counties by the farmers, during the intervals of their agricultural labours, for their own use, and for the supply of the adjoining districts.

The following tables show the quantity, quality, and declared value of woollens imported since the union. The imports previous to that period will be found in a general table of imports and exports under a subsequent head.

British Drapery imported into Ireland.

Years.	New.	Old.	Ornamented.
	Yards.	Yards.	Yards.
1801	887,903	1,078,381	29,063
1802	929,325	1,470,466	56,839
1803	571,674	1,190,143	42,237
1804	857,731	1,351,209	56,464
1805	842,811	1,517,561	65,223
1806	659,319	1,472,974	43,479
1807	917,025	1,545,543	59,725
1808	1,399,155	1,678,945	58,414
1809	1,484,958	1,796,986	34,419
1810	1,555,667	1,253,113	44,115
1811	1,421,793	1,573,860	42,682
1812	1,506,832	2,270,166	29,865
1813	1,627,583	2,648,999	25,856
1814	976,521	1,999,376	15,677
1815	739,078	1,064,904	1,953
1816	546,217	767,315	7,080
1817	912,934	1,259,245	9,902
1818	873,363	1,368,948	14,515
1819	911,240	1,436,539	......
1820	733,337	987,121	......
1821	1,212,437	1,289,623	......
1822	1,437,662	1,188,366	......

Statement of the Qualities and Values of British Woollens Imported.

	1814.		1815.		1816.		1817.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Yards.	L.	Yards.	L.	Yards.	L.	Yards.	L.
Cloths of all sorts................	62,773	781,205	28,677	427,993	24,437	325,138	39,334	498,192
Coatings..............................	130	575	2,540	10,028	41	260	80	464
Kerseymeres.........................	4,221	51,508	7,248	114,247	4,002	60,817	5,213	62,875
Baizes.................................	162	850	138	649	91	555	310	216
Flannels...............................	245,447	32,341	232,183	23,724	200,123	18,762	259,305	24,511
Stuffs..................................	36,241	72,457	11,920	34,036	8,131	20,845	9,888	21,399
Stockings..............................	25,138	29,580	22,506	26,855	12,385	14,086	13,036	14,555
Other Hosiery........................	...	21,511	...	4,375	...	4,951	...	4,358
Tapes, &c.............................	...	3,124	...	9,357	...	6,629	...	13,169
Woollens, Mixed....................	206,424	37,832	104,910	29,849	121,483	25,444	252,542	40,847
Woollen and Worsted Yarns....	884,152	125,015	683,683	103,139	523,638	65,612	625,185	73,268

	1818.		1819.		1820.		1821.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Yards.	L.	Yards.	L.	Yards.	L.	Yards.	L.
Cloths of all sorts................	51,465	610,888	48,156	599,205	36,275	423,441	48,990	598,765
Coatings..............................	302	2,483	78	551	37	310	...	...
Kerseymeres.........................	3,788	46,560	4,327	48,732	3,453	35,743	4,389	39,827
Baizes.................................	253	1,123	399	2,055	239	1,757	339	1,707
Flannels...............................	291,875	29,155	232,753	21,313	157,362	15,281	281,228	24,940
Stuffs..................................	28,599	42,086	19,636	51,100	17,893	47,855	30,542	77,382
Stockings..............................	20,235	20,803	25,092	22,733	33,095	28,831	37,327	31,190
Other Hosiery........................	...	9,690	...	759	...	955	...	5,890
Tapes, &c.............................	...	3,970	...	5,529	...	4,996	...	...
Woollens, Mixed....................	149,090	22,384	121,280	21,461	45,082	7,423	71,102	12,511
Woollen and Worsted Yarns...	472,721	71,279	712,574	95,047	700,556	90,256	842,801	90,015

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The same legislative measure which deprived Ireland of its woollen manufacture stated, that "if the Irish turned their industry and skill to the settling and improving of the linen manufacture, they should receive all the countenance, favour, and protection for its encouragement, and promotion to all the advantage and profit they might be capable of deriving from it." This declaration should not lead to the inference that the manufacture had been previously unknown or disregarded in Ireland. On the contrary, the use of linen was so prevalent amongst the higher orders, that sumptuary laws were enacted to check its excessive use. The unfortunate Earl of Strafford seems also to have anticipated the views of the British manufacturers on the subject. He, however, took a more honest, and perhaps a more judicious course. Instead of extinguishing the woollen trade by exclusive duties, he laboured to foster that of linen. He imported flax seed in large quantities from Holland, and held out premiums to induce Flemings and Dutchmen acquainted with the manufacture to settle here. On these laudable objects he spent upwards of L.30,000 of his private fortune; and his example was followed by the Duke of Ormond. Still, however, the woollen trade prevailed, particularly in the south and west, where the climate and the extensive pasturage for sheep insured a copious and cheap supply of the raw material. In the same spirit, an act was passed by the English parliament in 1696, to encourage foreign linen manufacturers to settle in Ireland; and with that view all articles made of flax or hemp in this country were admitted into England duty free, a privilege which is estimated to have given that branch of trade an advantage of L.25 per cent. over other nations in the English market. The Irish parliament, responding to the sentiments and wishes of that of England, promised that "it would heartily endeavour to establish the linen and hempen manufacture, so as to render it useful to both kingdoms;" adding, that "it hoped to find such a temperament in respect to the woollen trade here, that the same may not be injurious to England." The "temperament" here announced was evinced most effectually by laying prohibitory duties on the export of its own woollens, thus accepting the compact on the part of Ireland, and giving the country an incontrovertible claim upon England for a perpetual encouragement of that branch which was to be nurtured in lieu of the natural staple of the country. In furtherance of the measures mutually agreed on between both kingdoms, a board of trustees for the encouragement of the linen manufacture was established in 1710, consisting of a number of individuals of most influence in each province. Under its control a code of regulations was devised and maintained, which extended to the most minute particulars of the processes, and had the effect for many years of securing the fabric a decided preference both in the home and foreign market. A large sum was annually granted to this board, for premiums and the supply of wheels and other implements, which was continued till the year 1830, when the grants were discontinued, and the board consequently ceased to act. The flax seed is chiefly imported. Little is grown in the country, as, notwithstanding all the exertions made by the grower, the plant raised from it is considered as of inferior quality. The principal part of the seed is brought from America, the remainder from Holland, Prussia, and Great Britain. The following table shows the number of hogsheads and of acres sown during a period of four years.

	Hogsheads.	Acres.		Hogsheads.	Acres.
1818	47,607	80,785	1820	52,416	77,755
1819	44,431	91,728	1821	45,163	83,312

The three following tables show the value of the brown or unbleached linen sold in the several linen markets in Ireland during a period of four years; also the state of the export of linens both plain and coloured, and of linen yarn, in periods of ten years each since the formation of the linen board in 1710; exhibiting both the total amount of quantity and value during each period, and the average annual amount of quantity and value for each year in the respective periods. The sums stated in the former of these tables are the first cost paid to the manufacturer by the country purchaser; the value of most of the linen sold is afterwards considerably increased by the process of bleaching and other treatment.

Total of Brown or Unbleached Linen sold in Ireland.

Years.	Leinster.	Ulster.	Munster.	Connaught.	Total.
	L.	L.	L.	L.	L.
1822	285,354	2,066,122	68,870	117,664	2,538,010
1823	336,698	2,127,529	82,202	130,914	2,677,343
1824	207,638	1,968,180	95,195	140,856	2,411,869
1825	192,888	2,109,309	110,420	168,090	2,580,707
Total	1,022,578	8,271,140	356,687	557,524	10,207,929

State of the Exports of Linen and Linen Yarn from 1710 *to* 1824.

Periods of Ten Years.	Total of Linen and Yarn Exported.				
	Quantity.		Official Value.		
	Linen.	Yarn.	Linen.	Yarn.	Total.
	Yards.	Cwts.	L.	L.	L.
1720	19,812,816	121,942	1,137,354	1,122,869	2,260,223
1730	38,259,347	147,238	1,912,959	872,387	2,785,346
1740	52,479,565	150,139	3,284,519	848,762	4,133,281
1750	74,916,255	208,537	5,166,551	1,251,248	6,417,799
1760	127,159,229	260,944	8,187,714	1,565,677	9,753,391
1770	160,874,400	333,920	10,718,281	2,003,538	12,721,819
1780	203,108,197	317,525	14,434,318	1,905,175	16,339,493
1790	251,892,458	321,553	16,818,992	1,941,346	18,760,338
1800	409,729,904	204,837	27,309,717	1,229,051	28,538,768
1810	381,636,867	126,572	25,561,259	759,438	26,320,697
1820	418,578,079	130,980	27,919,743	785,889	28,705,632
1823	176,851,345	29,664	11,789,988	177,994	11,967,982
Total...	2,315,298,462	2,353,851	154,241,395	14,463,374	168,704,769

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Periods of Ten Years.	Annual Average of Linen and Yarn Exported.				
	Quantity.		Official Value.		
	Linen.	Yarn.	Linen.	Yarn.	Total.
	Yards.	Cwts.	L.	L.	L.
1720	1,981,281	12,194	113,735	112,286	226,021
1730	3,825,934	14,723	191,295	87,238	278,533
1740	5,247,956	15,013	328,451	84,876	413,327
1750	7,491,625	20,853	516,655	125,124	641,779
1760	12,715,922	26,094	818,771	156,771	975,542
1770	16,087,440	33,392	1,071,828	200,353	1,272,181
1780	20,310,819	31,752	1,443,431	190,517	1,633,948
1790	25,189,245	32,155	1,681,899	194,134	1,876,033
1800	40,972,990	20,483	2,730,971	122,905	2,853,876
1810	38,163,686	12,657	2,556,125	75,943	2,632,068
1820	41,857,807	13,098	2,791,974	78,588	2,870,562
1823	44,212,836	7,416	2,947,497	44,498	2,991,995
Average.	20,309,636	20,098	1,352,994	126,871	1,479,865

The following table exhibits the progress of the trade, with respect to the foreign demand, from 1820 till the latest period that public documents supply information.

An Account of the number of Yards of Irish Linen, and the number of Ells of Irish Sailcloth, exported from the United Kingdom; also of the quantities of Irish Linen imported into the United Kingdom, and the quantities retained for Home Consumption, in the years specified.

Years.	Linen Exported.	Sailcloth Exported.	Linen Imported.	Retained for Consumption.
	Yards.	Ells.	Yards.	Yards.
1820	12,455,419	18,117	42,665,928	33,243,497
1821	15,408,561	12,153	45,518,719	33,888,618
1822	15,931,939	16,039	43,226,710	30,372,703
1823	16,765,928	32,239	48,066,591	34,171,905
1824	17,933,195	66,185	46,466,950	31,292,598
1825	16,023,268	51,104	52,560,926	38,755,733
1826	10,868,407	55,178	Placed under coast regulations, and exempted from entry inwards, in the years subsequent to 1825.	
1827	14,022,496	52,413		
1828	11,924,603	83,903		
1829	11,924,918	51,256		
1830	13,244,269	32,550		
1831	14,738,358	28,185		

Cotton. The cotton manufacture was early an object of attention to the Irish parliament, which endeavoured to secure a monopoly of the home market by high import duties and by bounties. The first cotton mills were erected at Prosperous, in the county of Kildare, and in Belfast, about the year 1784. From that period till the union, it throve, in consequence of the measures adopted to prevent foreign competition. At the union it was arranged that the then existing duties should continue for eight years, after which they were to be gradually lowered, by eight annual reductions, in such manner that, after the year 1816, they should stand at ten per cent. *ad valorem*. The progress of the manufacture has been very slow as compared with that of Great Britain. The alteration of the scale of duties materially affected the home demand, and the immense capital and great superiority of the British artist have contributed much to secure to his manufacture a preference in the foreign market; yet it is a curious fact, that cottons printed in Dublin are sent to Manchester, where they are purchased by the Irish retailer, and obtain a preference by the home consumer. The following table of the quantity of cotton wool and yarn imported from all quarters affords a general view of the increase of the manufacture from its origin to 1823.

Account of the quantities of Cotton Wool and Yarn imported in 1771, and for every Fourth Year after, to 1823 inclusive.

Years.	Wool.	Yarn.
	Cwts.	Lbs.
1771	1,296	989
1775	3,063	742
1779	1,345	4,689
1783	4,550	6,516
1787	8,977	37,945
1791	14,949	205,515
1795	14,206	313,973
1799	12,130	508,038
1803	18,378	1,105,877
1807	18,429	1,060,334
1811	53,133	314,349
1815	20,551	950,879
1819	30,609	1,295,655
1823	34,162	1,799,259

Silk. The silk manufacture was introduced into Ireland by French emigrants after the revocation of the edict of Nantes. Its principal seat was the city of Dublin, where it was maintained by the aid of protecting duties. Some feeble attempts to fix it in the country parts failed completely. The last of these was so lately as 1825, when a company was formed for the purpose of fixing the trade on a secure basis in the south of Ireland, by rearing the silk-worm there, and thus having the benefit of the raw material for the labour of producing it; but after considerable expense had been incurred for the purchase of ground and the planting of mulberry trees, the scheme was relinquished as hopeless. One branch of the manufacture, a fabric of mixed worsted and silk, known here by the name of tabbinet, and in England by that of Irish poplin, is in considerable demand, both at home and elsewhere, for the richness and beauty of the texture. It is almost the only branch now flourishing. The general trade has been nearly annihilated by the removal of the protecting duties since the union. The following table of the official value of the silk imported since the commencement of the manufacture evidently proves its decline.

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Statement of the Value of Silk imported into Ireland, in Irish currency, for 1771, *and for every year afterwards to* 1823 *inclusive.*

1771	L.80,361	1799	L.63,626
1775	95,224	1803	74,423
1779	57,116	1807	53,225
1783	99,647	1811	71,203
1787	113,695	1815	68,528
1791	81,413	1819	65,372
1795	51,930	1823	45,523

The manufactures of iron, copper, and brass are very confined. The few iron founderies that still exist are limited to the execution of orders for works or manufactories carried on in the neighbourhood, which necessarily require the article to be made according to pattern, and on the spot. The same observation applies to those of copper, brass, and lead. The great advantage enjoyed by Great Britain in the inexhaustible stores of native metal, particularly iron, and of coal, together with the command of capital, and the elegance and cheapness of finish, arising from long experience, deprives Ireland of any reasonable hope of a successful competition in these branches, even for the wants of its own population.

The manufacture of glass was carried on to a considerable extent. There were four establishments in Dublin, two in Belfast, two in Cork, one in Waterford, and one in Derry. The raw material, except coal, was to be had in abundance, and in some places of excellent quality. The white glass was in much estimation for its goodness and brilliancy. The bottle manufacture supplied the entire demand of the country. But the trade has sunk under the effects of the assimilation of the duties with those in Britain. There is now scarcely an establishment existing.

Provision trade.

The making up of provisions for the army and navy, and for the foreign market, has long been a great source of wealth to the country. The principal part of the provision trade was carried on in Cork until of late years, when Belfast and Newry obtained a large share of it. The flesh is suffered to lie seven or eight days in salt before it is packed. The expedition with which the whole process is then carried on is astonishing. The beef, when cured, is assorted according to quality, in three classes, called planters', India, and common beef. The hides are returned to the grazier: those of the oldest cattle are most valued. The fat is disposed of to the tallow merchant. Bacon and hams are salted on an extensive scale for London, at Limerick, Clonmel, Waterford, and Belfast, in which last town the superior mode of preparing the article has given it a high character. The progress of the trade may be judged of by the following tables, exhibiting a statement of the quantities of salted meat and butter exported every fourth year from the union until 1825, when the official returns cease to give separate details for Ireland; and of the quantity of salt imported every tenth year, from the earliest returns to the same period.

Quantities of Beef, Pork, Bacon, Hams, Butter, and Lard, exported in every fourth year since the Union.

Years.	Butter and Pork.			Bacon and Ham.			Butter.			Lard.		
	Great Britain.	Foreign Parts.	Total.	Great Britain.	Foreign Parts.	Total.	Great Britain.	Foreign. Parts.	Total.	Great Britain.	Foreign Parts.	Total.
	Barrels.	Barrels.	Barrels.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
1801	132,406	28,434	160,840	21,100	61	21,161	250,620	54,046	304,666	1,565	484	2,049
1805	180,515	41,583	222,098	94,485	588	95,073	233,771	60,644	294,415	5,915	448	6,363
1809	191,836	70,908	262,744	165,038	2,084	167,122	330,155	55,798	385,953	14,795	1,487	16,282
1813	209,321	72,182	281,503	218,590	16,016	234,606	351,832	109,682	461,514	13,779	6,357	20,136
1817	195,496	67,109	262,605	179,093	11,932	191,025	320,180	77,785	397,965	10,740	6,441	17,181
1821	162,354	56,811	219,165	362,846	3,363	366,209	413,088	59,856	472,944	22,380	6,109	28,489
1825	147,290	33,986	181,276	361,139	1,139	362,278	425,670	48,491	474,161	31,882	3,397	35,279

Quantities of Salt imported from all parts of the World every tenth year from 1773 *to* 1823, *distinguishing Foreign, Rock, and White Salt.*

Years.	Foreign.	Rock.	White.
	Bushels.	Tons.	Bushels.
1773	271,168	14,220	345,026
1783	361,905	14,641	561,021
1793	204,514	16,406	267,279
1803	79,262	20,348	221,889
1813	317,979	34,042	415,555
1823	183,080	46,534	184,627

The use of spirituous liquors was known in Ireland at an early period. Camden, who derived his knowledge of the country from writers that lived long before himself, states that "the excessive moisture of the air and soil occasions many to be troubled with fluxes and catarrhs, particularly strangers, to stop which they have excellent usquebagh, much less heating and more drying than ours." But the article itself was not subjected to fiscal regulations till the reign of Charles II. when, in 1661, an excise duty of 4d. per gallon was laid on it, and continued at that rate till 1715, when an additional duty of 3d. was imposed; and two years after a further duty of 1d. This duty in 1719 produced a revenue of L.5785. In 1785 the duty was fixed at 1s. 2d., and so continued for some years. Its produce at that rate in 1791 was L.204,648. After a variety of changes, by which it was progressively raised, it stood in 1814 at 5s. 6d.; and though, for a year or two after, an attempt was made to augment it to 6s. the experiment was found to be so unsuccessful that it was lowered to the former rate after two years' trial. Severe restrictions were imposed, and a most complicated and harassing system of checks established, upon every part of the process, to prevent the possibility of yielding to the temptations to defraud the revenue occasioned by the enormous charge of duty. The consequence was, that the whole spirit trade was thrown into the hands of a few capitalists, who, by their mutual understanding, were enabled in their turn to check and control the officers of the revenue in their attempts to stop the issue of spirits from the distilleries which had not paid duty; whilst in the country parts, and particularly in the mountainous districts in the north and west, illicit distillation was carried to an extent that ultimately set all means to prevent it at defiance. No country has suffered more than Ireland from the excessive height to which the duties on home-made spirits have been carried. If heavy taxes, enforced by severe fiscal regulations, could make a people sober and industrious, the Irish would be the most so of any on the face of the earth. In

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order to make the possessors of property join heartily in suppressing illicit distillation, the novel expedient was resorted to of imposing heavy fines on every parish or townland in which an illicit still was found at work, and those detected in making it were transported for seven years. But instead of the effect looked for, these unheard-of severities not only did not check the practice, but filled the country with bloodshed, and established an organized resistance to the laws. In 1811, when the duty was 2s. 6d. per gallon, 6,500,000 gallons were paid for; in 1822, when it was raised to 5s. 6d., only 2,950,000 gallons were brought to charge, whilst at this latter period the commissioners of revenue, from whose reports this statement is extracted, estimate the total consumption at not less than 10,000,000 gallons, of which therefore upwards of 7,000,000 paid no duty. The profits on the manufacture were such as to induce the country people to run all risks, and to set at defiance every effort of the constituted authorities to put down the practice. Another mode was then at last resorted to. The duties were reduced in 1822 from 5s. 6d. to 2s. the wine gallon, or 2s. 4d. the imperial gallon. The results are best exhibited by the following table, showing the quantity of spirits that paid duty each year, the rate of duty, and the net amount of revenue collected.

Years.	Gallons Imperial Measure.	Rate per Gallon.	Net Amount of Revenue.
1821	2,649,179	5s. 6d. per Irish gal...	L.912,288
1822	2,328,387	Ditto....................	797,518
1823	3,348,505	Ditto....................	634,460
1824	6,690,315	2s. per English gallon	771,690
1825	9,262,744	Ditto....................	1,084,191
1826	6,837,408	2s. 10d. per imp. gal...	964,509
1827	8,260,919	Ditto....................	1,122,096
1828	9,937,903	Ditto....................	1,395,721
1829	9,212,223	Ditto....................	1,305,064
1830	9,004,539	2s. 10d., 3s., and 3s. 4d. per do.	1,409,128
1831	8,710,672	3s. 4d..................	1,451,580
1832	8,657,756	Ditto....................	1,442,845
1833	8,168,596	Ditto....................	1,360,769
1834	9,763,808	3s. 4d. and 2s. 4d.....	1,464,581

A superficial view of this table might lead to the conclusion that the consumption of spirits in Ireland had nearly trebled since 1823; but, in fact, the apparent increase was caused solely by the general use of licensed instead of illicit spirits under the reduced scale of duties. The measure was most effective, and it will be found by the succeeding table, exhibiting the progress of convictions under the illicit distillation laws, that the subsequent increase of duty in 1830 has been pernicious. The truth is, that 2s. 4d. was as high a duty as the article would bear, and the additional 6d. has again thrown the balance in favour of the smuggler, and led to a partial revival of illicit distillation. The subsequent reduction of the duty in 1834 proves that this financial error has been perceived and corrected.

Convictions for Illicit Distillations. (Inspectors of Prisons for 1829 *and* 1835.)

1822	1003	1829	617
1823	1057	1830	658
1824	912	1831	276
1825	994	1832	363
1826	824	1833	896
1827	693	1834	1149
1828	652		

From the preceding statements it is evident, that as long as the undue proportion between the duty and the intrinsic value of spirits induces a continuance of the practice of illicit distillation, no official returns can afford adequate data for calculating the quantity of home-made spirits consumed in the country. As far, however, as a conclusion can be drawn from the number of houses licensed for the retailing of spirituous liquors, it would appear that Ireland is not excessive in this point. The number of spirit licenses granted in 1834, in each part of the united kingdom, were, for

	New.	Renewed at an increased rate of duty.	Total.
England.......	546	46,766	47,312
Scotland......	432	15,846	16,278
Ireland........	1047	17,369	18,416
Total......	2025	79,981	82,006

Breweries.

There are breweries in most of the large towns in Ireland, not only adequate to the internal demand, but allowing an export, which has been increasing for the last few years. The importation of beer from Great Britain has been progressively diminishing for many years, particularly since the union, as will appear from the following table of the average amounts of the quantities of beer and ale imported in the several periods stated.

From 1721 to 1760....... 6,307, average during 40 years.
1760 to 1800.......56,323, average during 40 years.
1800 to 1810....... 3,710, average during 10 years.
1810 to 1821....... 512, average during 10 years.

It does not, however, appear that the consumption of home-brewed beer has increased in proportion to the diminution of that imported. The number of barrels of malt used in the breweries of Ireland in 1810 was 446,436; in 1822 it was only 361,301; and, according to another official account, the number of quarters of malt used by brewers in 1823 was 174,466, whilst in 1833 it was 192,867, an increase not at all proportional to the increase of the population during the same period.

The exports of ale and beer from Ireland, as compared with those from England and Scotland, show that the article produced here is increasing steadily in demand in foreign countries.

	England.	Scotland.	Ireland.
	Barrels.	Barrels.	Barrels.
1826	53,013	1,827	9,855
1827	42,602	1,679	10,000
1828	59,472	2,509	11,261
1829	71,842	3,304	14,499
1830	74,902	3,131	15,207

Agriculture.

Ireland, as has been already noticed, is, both from soil and climate, a pastoral country. The habits of the people tended to keep it such. Nor was it till the beginning of the last century that any efforts were made to introduce an attention to tillage upon an extended scale. Primate Boulter, when one of the lords-justices, pressed strongly on the British government the importance, or rather the necessity, of enforcing a tillage system; and for this purpose proposed a law in 1727, to compel landholders to till five acres out of every hundred in their possession, exclusive of meadows and bogs; and also to release tenants to the same extent from the penal covenants against tillage, inserted with equal want of policy and justice into their

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leases. Mr Dobbs, who wrote several valuable tracts on Ireland about the same period, ascribes the poverty of the country to the neglect of tillage. The Irish legislature at length became sensible of the necessity of some general and vigorous expedient to direct domestic industry into this channel. It saw a large sum annually remitted to England to purchase grain, producing a drain of capital, and holding out as it were a premium to indolence at home. The remedy devised was not the best, but it produced to a certain degree the effect. Bounties were given for corn brought by land-carriage to Dublin, where the demand for grain was greatest. The progress of the excitement thus produced appears by the progressive increase of the amount of bounties, which were ultimately withdrawn, partly because the desired object, the direction of public attention to this branch of national industry, had been attained, but more so in consequence of the many frauds and abuses which had crept into its management.

The amount of the bounties paid was, in

1764	L.5,483
1767	6,074
1770	18,706
1774	49,674
1777	61,786
1780	77,800

The counties which drew the largest amount of bounty were Tipperary, Kilkenny, Meath, Queen's, and Carlow.

The nature of the tenures by which land was held had also an unfavourable influence on the agricultural improvement of the country. After the transfer of by much the greater part of the territorial surface to Cromwell's adventurers, the original patentees in many instances were glad to grant leases at long terms of years, and in many cases in perpetuity, for what would now be considered as trifling considerations. These lands, as their value increased by the increased feeling of the permanency of the new government after the revolution, were re-let by the holders, who preferred to draw a fixed rent from them, rather than to hold them in their own hands. Hence arose the class of middlemen, sometimes in a triple or quadruple order, living in independence and idleness on the labours of the occupying tenant, the whole of whose earnings, beyond the means of a bare subsistence for his family, was drawn away from him by this succession of intermediate landlords.

The system of exaction thus produced was increased by the operation of the penal law, which forbade a Roman Catholic to hold any land if the rent did not amount to two thirds of the actual value, thus leaving one third only for the subsistence of the tenant and the payment of tithes and local taxes. Land was essential for the existence of the Catholic peasant, who could not afford to emigrate. He therefore paid the rack rent, and of course had the preference as a tenant; and the Protestant was forced to follow the example or quit the country.

The size of farms, as well as their mode of culture, varies greatly in different parts. Generally speaking, in the manufacturing districts of the north, the small allotments of land, there dignified by the name of farms, are limited to a few acres, the cultivators of which no more deserve the name of farmers than would the occupiers of mere cabbage gardens. In the grazing counties the farms are of very great extent, often spreading over upwards of a thousand acres; whilst in the counties in which greater attention is paid to tillage, they are more moderate in dimensions. The mixture of grazing and tillage so frequent in England is much less usual here, except on the farms of gentlemen, where both the feeding of stock and the growth of grain are carried on, in numerous instances, to as high a state of excellence as in any part of Great Britain. Nor are there any large tracts of country exclusively devoted to the breeding of cattle, as in the highlands of Scotland.

Grazing.

The grazing of various kinds of stock is seldom combined. A usual mode, with respect to black cattle, particularly in Connaught, is to collect yearling calves, which are fed till they are four years old, when they are sold, at the great annual fair at Ballinasloe, to the graziers of Limerick, Tipperary, Roscommon, and Meath, by whom, when fattened for the butcher, they are either shipped alive for Liverpool, or sent to the markets of Dublin and the larger northern towns, or to Limerick and Cork, where they are cured for exportation.

The dairy farms form a conspicuous feature in the rural economy of the country, occupying a still larger portion of the soil than that used by the grazier. Butter, much celebrated for its excellence, is exported in large quantities. That of Carlow bears the highest character in the foreign market. It may appear strange that a country whose character stands so high in the production of butter, should be so unsuccessful in that of cheese. Yet such is the fact. With the exception of some made in the county of Antrim, particularly at Carrickfergus, Irish cheese is of very inferior quality. The failure of the many attempts to produce a good article may in most cases be attributable to the want of that tact in the management of it during its fabrication, which is only to be acquired by long and persevering practice. Yet it is stated of Lord Hawarden, whose estate lies in one of the richest tracts in Tipperary, that two skilful persons from different parts of England, who had successively a fair course of trial, failed to make, from the milk produced from those fine pastures, a single cheese that combined the essential qualities of excellence of flavour and durability of keeping. Calves are seldom fattened except in the neighbourhood of large towns, where that meat is to be found of very fine quality. In the country parts it is the custom to slaughter the male calves when but a few days old; and the meat of them is sold to the lower classes, by whom it is distinguished by the name of slink veal.

The chief breeding counties for sheep are Roscommon, Galway, Clare, Limerick, and Tipperary. The flocks are usually managed by the herd, who attends the cattle; a regular shepherd, as in England, being seldom set over them. Folding is little practised, and the use of turnips for winter food is by no means general. In many parts sheep are kept for the sole purpose of supplying wool for the use of the owner's family. No county in Ireland equals Galway in the management of this valuable animal; and nowhere are finer flocks to be seen. There is reason to suppose that, in the time of Giraldus Cambrensis, the Irish breed of sheep was black. The introduction of the white breed of an improved kind is attributed to the English. Latterly much attention has been directed to the bettering of the stock, whether for the shambles, the wool comber, or the clothier, by judicious crossing. The merino sheep has latterly been brought over, and has been found to agree well with the soil and climate. On the mountains is found a breed similar to that of Wales, small, with nearly as much hair as wool.

The total number of sheep in the British isles is estimated by Mr Macculloch to have been, in the year 1830, as follows:—

England	26,500,000
Scotland	3,500,000
Ireland	2,000,000
United kingdom	32,000,000

The right of pasturage on mountains is frequently let to the inhabitants of a village in common, each of whom maintains on it a determinate stock of cows, goats, and sheep. In the apportionment five goats are considered as

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Horses for agricultural purposes are seldom of great excellence. But a breed for general use, both for draft and saddle, is much esteemed; and blood-horses of high price and repute are bred in the rich pastures of the principal grazing counties. In general this animal is treated with less care and greater harshness than in England. The old Irish hobby, a small but excellent breed, supposed to be derived from a Spanish race, is nearly extinct; yet some vestiges of it are still to be traced in the western parts of Connaught, and in Kerry. In this latter county, a small breed of cows, very hardy, and excellent milkers, is still kept up.

Hogs are kept in great numbers. The native breed is tall, bony, and ill proportioned; but crosses from some of the most approved British stocks, particularly the Leicester, have been introduced, to the great improvement of the animal. In general the cottier's hog is the inmate of his cabin, a member of the family, upon whom the owner chiefly depends for the payment of his rent. Hence it acquires a docility of manners unknown elsewhere. Its food is invariably the potato. When fit for market it is either slaughtered in the provision markets of Cork, Waterford, Belfast, and Newry, or exported alive, chiefly to Liverpool.

Wakefield, in his observations on the state of tillage, classes the country into nine agricultural districts, according to the peculiarities of soil and culture. The first comprehends the flat parts of Antrim, the eastern side of Tyrone, and the counties of Down, Armagh, Monaghan, and Cavan. In these the farms are small, and spade cultivation common. Potatoes, oats, and flax, are the principal crops. The second district comprehends the counties of Londonderry and Donegal, the mountainous part of Antrim, and the north and west of Tyrone. Agriculture is in a more backward state here than in the preceding district. Wheat is little known. In the third, which is confined to the northern parts of Fermanagh, the system of tillage is better, and the farms larger. Wheat is largely planted, but oats form the great staple crop. The whole of the north-west of Ireland, comprehending Sligo, Mayo, Galway, Clare, with Roscommon and Longford, forms the fourth district. Oats is still the prevalent crop, but much barley is also raised in the districts near the sea. The plough is often drawn by four horses abreast. Illicit distillation is carried on here upon an extensive scale, and much of the land is leased to tenants in common, according to what is called the corn-acre system. In the fifth district, which comprehends Limerick, Kerry, the south-western and northern parts of Cork, and all Waterford, cultivation is not far advanced. The greater part is a grazing country. Where tillage prevails, the land is much subdivided, and the farms consequently very small. The sixth district includes the southern part of Cork. Spade culture is here frequent, the farms small, and hogs constitute the main dependence of the poor. The best farming in Ireland is to be seen in the seventh district, which takes in Tipperary, the Queen's, and King's Counties. Tillage is carried on in a systematic manner, and wheat forms an important part of the crop. The character of the eighth district, which comprehends Kilkenny, Kildare, Carlow, Westmeath, Meath, and Louth, much resembles that of the preceding, except that the system of tillage is not managed with so much neatness and precision. The farms are large, and the English mode of treatment adopted; but the details are executed in a more slovenly manner. Wexford, and the arable part of Wicklow, form the ninth district. Beans are largely cultivated. A very singular mode of ploughing may be seen here. One man leads the horses, another holds the plough, and a third sits on it to keep it down.

The preceding sketch shows that oats are the prevailing crop, then wheat and barley; flax on an extensive scale is confined to the northern counties. Potatoes are universally cultivated. It is the crop on which the great mass of the population depends for its subsistence; its failure, wherever it occurs, produces a famine. The outcry against the clumsy and defective construction of agricultural implements is every year less merited. In most parts much attention is paid to their construction; and, where they differ from those most in vogue in Great Britain, the cause can be traced to the peculiarities of the soil. The spade is narrower in the blade than the English, and longer in the handle. In many parts its use is supplied by a narrow spade, with a projection for the foot only on one side; it is called a loy. In cutting turf, a kind of double loy, called a slane, is used. Oxen are little employed in tillage. When used in the plough they are yoked sometimes by the horns, sometimes by the breast. The Scotch cart or dray, with two large wheels and a single horse, is to be found in every part, its structure having been found best adapted to a hilly country such as Ireland generally is. It has in a great measure superseded the old Irish car. In the mountainous parts the slide-cart without wheels is still employed. The ends of the shafts, which lie on the ground and are dragged on by the horse, being shod with iron, allow the vehicle to slide along with considerable facility. The fences vary extremely, according to the character of the soil. In the rocky districts in the north and west they are mostly dry-stone walls, sometimes of great thickness at bottom, being used as well for a means of getting rid of the numerous loose stones on the surface, as for the enclosing of the land. A mound, planted at top with furze, or gorse, is a common fence in those parts where fuel is scarce. In the more improved parts white thorn hedges are most usual. Lime and limestone gravel is the most general manure. It is often used mixed with turf mould. On the sea-coasts coralline sand and sea-weed are employed; the former is often conveyed to great distances into the interior. Paring and burning, though prohibited by statutory enactments, which impose a fine of ten pounds on the person practising it, is very frequent, and found, under judicious restrictions, to be highly salutary.

As the potato forms the main article of food for the general population of the country, it is evident that by much the greater part of the other crops raised must be disposed of in other countries, and therefore that the quantities exported will form no bad criterion of the progress of tillage, and of the crops to which it has been chiefly directed; but as this point comes more properly under another division of the work, the reader is referred to it, where he will find, in the statement of exports, an enumeration of the quantities of agricultural produce sent out of the country at different periods.

Fisheries. The peculiar natural advantages of Ireland with respect to the fisheries were long since noticed. Sir William Temple observes of them, that "they might prove a mine under water as rich as any under ground." Young asserts with truth, that "there is scarcely a part of Ireland but what is well situated for some fishery of consequence; and that her coasts, and innumerable inlets and creeks, are the resort of vast shoals of herring, cod, ling, hake, mackerel, &c. which might be converted into funds of wealth." Daniel, in his *Rural Sports*, speaking of the inland fisheries, says, that "the waters of Ireland abound in all that can invite an angler to their banks; they are more largely stored, and with fish of a better quality, than elsewhere in the

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united kingdom." Such descriptions would lead to the conclusion that the fisheries were in a very flourishing condition. The contrary is the fact. The several attempts to establish them have failed, not certainly from want of fostering superintendence, but more probably from injudicious nurture, perhaps over attention. In the beginning of the reign of George III. the Irish parliament established a liberal system of bounties, particularly for the herring fisheries. The result of the experiment was the very reverse of what had been anticipated by the devisers of the measure. The following table shows that the import of herrings for nine years after the granting of the bounties, exceeded that of the nine preceding years by no less than 155,156 barrels.

Quantity of Herrings imported into Ireland for Nine Years before and Nine Years after the enactment of the Bounty System.

Years.	Before the Bounty.			Years.	After the Bounty.		
	Great Britain.	Elsewhere.	Total.		Great Britain.	Elsewhere.	Total.
	Barrels.	Barrels.	Barrels.		Barrels.	Barrels.	Barrels.
1756	28,999	1277	30,276	1765	14,587	17,030	31,617
1757	28,955	2080	31,035	1766	35,552	24,555	60,107
1758	29,960	1370	31,330	1767	12,094	12,618	24,712
1759	23,611	113	23,724	1768	16,640	23,252	39,892
1760	17,038	...	17,009	1769	11,286	25,847	37,113
1761	20,411	142	20,554	1770	22,891	23,655	46,546
1762	21,388	844	22,232	1771	12,952	26,555	39,507
1763	23,519	2156	25,675	1772	10,445	34,241	44,686
1764	14,932	8661	23,593	1773	13,471	40,539	54,101
Average...	23,201	1847	25,048	Average...	16,657	25,365	42,022

The chief seat of the herring fishery was along the north-western coast, from Lough Swilly to Broadhaven. To secure it, large sums were laid out in establishing stations for taking and curing the fish in the islands of the Rosses; but, after much expenditure, the fish deserted the shores about the year 1780, and the fisheries were of course abandoned. The Nymph Bank, on the southern coast, was discovered in 1736. It abounded with white fish, and a company was formed to take advantage of it; but the breaking out of the Spanish war three years afterwards put an end to the project. It afterwards remained unnoticed till 1801, when, through the exertions of Captain Robert Fraser, a company was formed for the special purpose of supplying the London market with fresh fish from it by means of well-boats; but the scheme proved abortive, apparently from internal mismanagement. In 1819, the attention of the legislature was again directed to the improvement of this source of national wealth, and a large sum was granted annually to commissioners, partly for the payment of bounties, partly for the erection of fishing piers, and partly for the issue of loans for building boats and providing fishing tackle. After twelve years' experience the grants were discontinued, and the commission was revoked. The following tables will serve to show the results of the efforts made to establish fisheries previously to the formation of the Fishery Board in 1819, and the effects of the exertions made by the commissioners, as stated by themselves in their reports.

Exports and Imports of Cured Fish at different periods before the establishment of the Fishery Board.

EXPORTS.										
	1711.	1734.	1738.	1740.	1762.	1783.	1807.	1808.	1809.	1810.
Cod, barrels	141	2	...	...	32	272	...	...	...	...
Hake, cwts	1859	470	1532	1245	1163	1,367	...	...	...	...
Herring, barrels	6674	21,057	7743	258	5838	48,441	4248	743	2	24
Ling, cwts	27	...	1	...	77	170	381	867	282	...
Mackerel, barrels	...	20	110	293	671	...	...	...	...	...
Pilchards, hogsheads	...	2,594	2754	366	...	...	...	...	...	...
Salmon, tons	920	545	513	383	489	253	121	52	50	48
IMPORTS.										
	1711.	1734.	1738.	1740.	1762.	1783.	1807.	1808.	1809.	1810.
Cod, cwts	...	300	122	678	427	531	10,822	3,674	8,449	14,022
Cod, barrels	14	15	...	22	33	...	33	195	229	59
Hake, cwts	...	...	...	...	36	3	...	...	...	...
Herring, barrels	...	...	...	...	18	4324	22,248	42,597	33,531	37,733
Ling, cwts	...	39	...	43	214	281	1,600	2,312	1,138	2,255
Mackerel	...	...	...	...	18	...	...	...	...	...
Pilchards, hogsheads	...	...	...	...	69	...	...	...	...	...
Salmon, tons	13	1	1	6	21	47	3	1	12	25

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Statement of the Quantities of Herrings, and of Cod and other Fish, on which Bounty was allowed by the Fishery Board.

Years.	Herrings.	Cod.	Ling.	Hake.	Haddock.	Glasson.	Cong. Eel.	Years.	Herrings.	Cod.	Ling.	Hake.	Haddock.	Glasson.	Cong. Eel.
	Bar.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.		Bar.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
1820	...	5	1	37	...	768	...	1826	41,376	2574	4418	11,916	224	2377	1603
1821	490	471	1094	6,019	1	3204	154	1827	26,698	3763	4052	9,929	492	4145	1867
1822	8,901	1282	2433	9,035	51	1177	513	1828	15,784	3312	3197	23,964	444	2718	1067
1823	7,243	2526	3743	7,923	116	4930	774	1829	13,513	4613	4319	16,235	171	7989	1201
1824	19,827	3076	4416	12,060	354	1203	1185	1830	16,855	7880	4852	32,088	573	7898	2295
1825	34,264	2934	2645	9,500	322	1339	610								

Number of Fishermen enrolled as Sea Fencibles at the several Fishing Stations of Ireland in 1810.

Buncrara	869	Galway	452	Kinsale	655
Rutland	699	Tarbert	318	Cove	731
Killybegs	539	Tralee	521	Passage	446
Killala	289	Dingle	994	Wexford	312
Broadhaven	143	Kenmare	393	Wicklow	412
Westport	264	Berehaven	205	Malahide	482
Bunowen	249	C. Townsend	449	C. Fergus	469
	3052		3332		3507

Total number of fishermen enrolled, 9891.

Number of Vessels and Men engaged in the Fisheries during the continuance of the Fishery Board.

Years.	Decked.		Half Decked.		Open Sail.		Row Boats.		Total.
	No.	Men.	No.	Men.	No.	Men.	No.	Men.	Men.
1822	294	1908	421	2248	2051	10,581	4889	21,422	36,159
1823	306	2095	286	1684	2516	12,733	6196	28,380	44,892
1824	354	1623	406	1479	2489	9,997	7150	27,142	49,448
1825	377	2416	446	2371	2562	13,071	7497	34,296	52,482
1826	378	2504	485	1947	2334	11,838	7626	38,931	57,809
1827	305	1981	694	3478	1879	9,470	9147	43,115	58,044
1828	337	2155	669	3311	1822	9,378	9298	44,477	59,321
1829	353	2246	711	3566	2373	11,936	9174	45,673	63,421
1830	345	2147	769	3852	2483	12,560	9522	46,212	64,771

Whales and sun-fish are often seen off the western coast. The fishing of them has frequently been attempted, but always with loss. Seals are frequent along the rocky shores. They are occasionally shot; but as they are extremely wary, and must be struck on the head in order to kill them at once, they are seldom taken in this manner. They are sometimes, particularly the young ones, caught by moonlight, in the caverns where they sleep; but the attempt is very venturous. The old ones bite most furiously in defence of their young; and, as they are supposed never to let go their hold until they hear something crash between their teeth, the seal-catchers have bags, with charcoal quilted into them, fixed on their arms by way of defence. Most of the embouchures of the great rivers have salmon fisheries attached to them. That at Coleraine is particularly valuable; nearly all the fish caught there is sent fresh to Liverpool packed in ice. Eels are caught in large quantities in the large rivers, particularly after floods. As they do not take the bait, the usual mode of entrapping them is by stretching coarse hay ropes under water at the bridges, in which they are entangled while shooting down the stream. Shell-fish is abundant, particularly on the western and southern coasts. Oysters of much repute are raised at Carlingford; those from Burren and Lissadil on the western coast are also thought worthy of being transported across the island to Dublin. Muscle-beds are abundant, especially in the south; but they are sought after chiefly on account of the pearls occasionally found in them. In Cork the muscles are caught in sunny weather, at which time only they open their shells. The fisherman thrusts an osier twig into the aperture, the fish closes on it, and is drawn up. Pearls of the size of a pea, but seldom of good quality, are found in them.

Circulating medium.

The circulating medium in Ireland was, until lately, subject to a great variety of alterations. Without entering into the disputed question of the existence of a mint in Ireland established by the Ostmen or Danes, the first certain account of a mint there is that established in 1210, by King John, who caused pennies, halfpennies, and farthings to be coined and made current by proclamation. Further coinages were made by Henry III. and Edward I. The latter prince was the first who added the title of DOMINUS HIBERNIE to that of REX ANGLIE on his Irish coinage. It consisted of groats, halfpence and farthings. The first important alteration as to value was in the latter part of the reign of Edward III. who caused the ounce of silver to be cut into twenty-six deniers or pennies, instead of twenty, as before, which caused precisely the same depreciation of eight and one third per cent. in the Irish, as compared with the British currency, that lately existed, until the final assimilation in 1825. Henry VI. or rather the Duke of York, his lieutenant in Ireland, had mints in Dublin and Trim, in which both sil-

Statistics. ver and copper were coined. In the beginning of the subsequent reign of Edward IV. the value of the silver coins was raised to the double of its previous amount. The consequence was an enormous increase of price in all the necessaries of life; to remedy which, the Irish parliament enacted, that the master of the mint should strike, in the castles of Dublin and Trim, and in the town of Drogheda, five kinds of silver coins; the gross (or groat), the demigross, the denier (or penny), the demi-denier, and quadrant (or farthing); eleven groats to weigh an ounce troy, and each, unclipped, to pass for fourpence. A very few years afterwards, the price of silver was again raised so excessively, that the difference between the Irish and English groat was fifty per cent. in a pound of bullion. In the reign of Henry VII. the difference between the two coinages was one third. Soon after the accession of Henry VIII. the coin in Ireland was so clipped, defaced, and scarce, that the Earl of Surrey, then lord-lieutenant, sued for his recall, in consequence of the want of money to carry on the war against the Irish. Elizabeth ordered the ounce of silver to be cut into sixty pennies, so that the coin of that name was reduced in weight from the twentieth to the sixtieth part of an ounce. The total value of the money coined in Ireland by that princess is said to have been L.94,577. 19s. 6d. English, which, at the rate of sixteen pence Irish for a shilling English, amounts to L.118,222. 9s. 4½d. Irish. The Irish shilling, or harp as it was called, from the impression on its reverse, was worth ninepence English. By a proclamation issued in the fifth year of James I. the same proportion of values was continued. In 1613 English money was current in Ireland at an increased value; the English five-shilling crown-piece passing for six shillings and eightpence, and the other coins in proportion. The exchange between Dublin and London was at twenty-one shillings Irish for fifteen English, with sixpence or eightpence per pound extra, payable in London. By a proclamation in 1637, the name of Irish money was ordered to be abolished, and all payments reduced to English sterling money. About 1672, small change was so scarce in Ireland, that towns and private dealers were obliged to issue copper tokens. James II., on his arrival in Dublin in 1688, issued a proclamation, by which the English guinea was to pass current at L.1. 4s., the crown-piece at 5s. 5d., and all lesser coins in the same proportion. In 1690, he depreciated still further the value of the coin, by the issue of pieces of base metal, which were to pass at a nominal value far above their intrinsic worth; so that the coins issued of the nominal value of L.965,375 according to some, but, according to others, of L.1,596,799, were really worth no more than L.6495, estimating the metal at fourpence per pound. On the accession of William, this coinage was cried down. In 1725, the new gold coin of Portugal was made current in Ireland, the largest coin, or Portugal piece, being rated at L.4. About the same time, in consequence of the scarcity of small change, Wood obtained his patent for the issue of a copper currency, which was prevented by the literary exertions of Dean Swift in his celebrated publications called the *Drapier's Letters*. In 1780, the acts of parliament prohibiting the carrying of gold or silver into Ireland were repealed. At that time the value of the precious metals in circulation as specie, or hoarded, was estimated at L.3,000,000 Irish. No further legislative change took place until the assimilation of the Irish and English currency in 1825, previously to which, however, the want of a metallic circulation was so severely felt, particularly during some periods of the French war, that private bankers and other dealers issued notes or tickets for small sums, from five shillings down to twopence-halfpenny; and also copper tokens of a great variety of values and impressions. The character of the silver currency was much deteriorated during the same period, in consequence of the arrival of several regiments of English militia from Warwickshire and the neighbouring manufacturing counties, who, taking advantage of the defaced state of the Irish coinage of shillings, counterfeited them so ingeniously, that the country was for a time inundated with this description of base money. The evils of this combined pressure of the scarcity of legal and the abundance of counterfeit coin, was ultimately remedied by the issue of silver tokens, estimated at six shillings, tenpence, and fivepence, by the Bank of Ireland, which circulated freely until they were replaced by the issue of a pure standard coinage of silver from the royal mint.

Banking. The entire banking business of Ireland, until 1783, was in the hands of private individuals, who often issued notes to an amount not only far beyond their respective capitals, but exceeding, in a great degree, what the wants of the country required, or its credit could support. To remedy the evil effects of a system so pernicious, a national bank was established in that year, with similar privileges to those of the Bank of England in respect to the restriction of more than six partners in a private bank. The injury that Ireland has sustained from the repeated failure of banks may be mainly attributable to this injudicious regulation. The loss that the country has suffered by the failure of banks may be described in a few words. In 1804, there were fifty registered banks. Since that year, many more have been opened; but all have failed, one after another, with the exception of four in Dublin, three in Belfast, and a few that have withdrawn from business. In 1821, in consequence of the failure of eleven banks nearly at the same time in the south of Ireland, government made an arrangement with the Bank of Ireland, by which joint-stock companies were allowed to be established at the distance of fifty Irish miles from Dublin, in return for which concession, that company was permitted to increase its capital L.500,000; but, in consequence of several restrictions remaining unrepealed, no new company was formed until 1825, when the Northern Banking Company of Belfast began to act on the new system. In the same year the Provincial Bank of Ireland began business with a capital of L.2,000,000; and the Bank of Ireland has established branch banks in several of the larger towns. The capital of the Bank of Ireland at its commencement amounted to L.600,000. It has been since increased at different periods; and in 1821 it amounted to L.3,000,000. At present no bank with more than six partners can be established within fifty Irish miles of Dublin; nor can such bank draw bills on Dublin for less than L.50, or at a shorter date than six months, which is a virtual prohibition of the drawing of such bills. The Bank of Ireland draws on London at twenty days date, and discounts at the rate of five per cent. Its charter expires in 1838.

The following table exhibits the amount of the issue of Bank of Ireland notes, and the highest and lowest aggregate amount of Bank of Ireland notes and post bills issued, as far as can be collected from official documents :—

Issue of Bank of Ireland Notes and Post Bills for every Fourth Year from 1798 *inclusive.*

Years.	Bank Notes.				Post Bills.		Total of Notes and Post Bills.	
	Of L.5 and upwards.		Under L.5.					
	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.
1798	859,337	1,101,624	......	......	277,718	365,183	1,137,056	1,465,198
1802	1,917,730	2,391,168	......	......	490,485	601,995	2,470,630	2,934,334
1806	1,119,393	1,325,940	763,177	929,934	436,706	646,799	2,341,784	2,799,036
1810	1,327,617	1,560,567	772,979	844,620	832,199	976,176	3,046,313	3,381,363
1814	1,676,450	2,067,761	1,231,098	1,507,362	1,122,049	1,393,624	4,099,647	4,760,551
1818	1,809,495	2,050,319	1,004,838	1,260,579	1,264,649	1,448,540	4,304,877	4,568,375
1822	1,792,090	2,077,321	1,267,361	1,529,888	1,582,981	1,940,393	4,787,884	5,451,508

Average Amount of Bank of Ireland Notes, including Post Bills.

Years	L.5 and upwards.			Under L.5.			Total.		
	L.	s.	d.	L.	s.	d.	L.	s.	d.
1820	2,894,777	5	0	1,314,806	15	0	4,209,584	0	0
1821	3,501,119	11	0	1,710,603	3	0	5,211,792	14	0
1822	3,618,111	1	0	1,552,321	2	0	5,170,432	3	0
1823	3,528,625	7	0	1,588,764	7	0	5,117,389	14	0
1824	3,890,337	8	0	1,732,118	6	0	5,022,455	14	0
1825	4,666,995	0	0	1,964,354	8	0	6,411,349	8	0

In the Provincial Bank, twenty-five per cent., or L.500,000, has been paid up. Its head is in London, but it has offices in all the large towns of Ireland. The business of the branch banks is managed, under the control of the directors in London, by the managers, with the aid of two or more residents in the district, who must be holders of ten shares each. This bank has had several severe runs to contend against. In 1828, L.1,000,000 in gold was sent from England to maintain its credit. Its notes are received in the treasury in payment of taxes; and it is the bank of the excise, post-office, and stamp-departments, in all places beyond the restricted limit. The dividends have been at the rate of four, five, and, since December 1832, of six per cent. Its stock is at a high premium. The Northern Bank transacts business on similar principles with the Provincial, but on a smaller scale. The Hibernian Joint-Stock Loan Company was formed by some Roman Catholic gentlemen and merchants, in consequence of their exclusion from seats in the direction of the Bank of Ireland. Its nominal capital was L.1,000,000, in 10,000 shares, of which twenty-five per cent. was paid in. It issues no notes, and has no branch offices. In 1824, the company obtained an act, which gave them some additional facilities in transacting their concerns. Two new joint-stock banking companies were commenced in the year 1833; the one, called the Agricultural and Commercial Bank of Ireland, is managed in Ireland, and rests on Irish capital; the other, called the National Bank of Ireland, has a proprietary in London, who have contributed a large capital on the principle of advancing to any bank formed in connection with it in Ireland, a sum equal to that subscribed there, and receiving half of the profits of the joint capital. Both of these banks have branches in some of the great towns. Private banks are now to be met only in Dublin, where there are but four. Ireland has but few manufactures and little commerce, and banks abound only in wealthy and commercial countries. Another striking circumstance is the vast proportion of notes under five pounds issued by the country banks. This is accounted for by the smallness of the transactions, and the peculiarities of Irish trade, which in the north is chiefly confined to the domestic manufacture of linen; and in the south to the provision trade, the supplies for which are furnished, in consequence of the great subdivision of land, by a number of dealers, each of whom can furnish a very limited quantity. The fairs and markets are attended by multitudes of people, bringing each his butter, corn, and poultry, for sale, few of whom individually take away to the amount of five pounds.

A reference to the preceding table of the issue of Bank of Ireland notes will confirm this position, by showing that the increased issue of that bank, since the commencement of notes under five pounds, has arisen from the increased number of those under that value.

Account of the Number of Country Bank Notes stamped each year from 1820 *to* 1831 *both inclusive.*

Years.	Between L.1 & L.5.	Between L.5 & L.10.	Between L.10 & L.50.	Amounting to L.50.	Between L.50 & L.100.
1820	435,369	26,800	19,253	240	110
1821	354,041 from 15th Aug. 1½.	5,700	6,146	75	24
1822	334,570	10,000	8,849	120	100
1823	270,301	5,800	5,925	30	20
1824	669,602	16,000	12,200	200	...
1825	1,213,486	28,814	26,000	500	300
1826	558,231	30,405	14,450	...	...
1827	406,435	3,300	5,269	...	...
1828	86,000	...	...	...	...
1829	46,100	...	...	...	...
1830	136,998	...	1,500	...	...
1831	64,000	...	...	...	...

The system of savings' banks was introduced from Scotland in 1817, when an act was passed, by which a fixed interest of L.4 per cent., resting upon public security, was granted to the depositors. This rate was in 1828 reduced to three per cent., in consequence of the influx of deposits from persons who thereby derived a larger interest from their lodgments than what was then attainable from funded security. The confidence at first excited in favour of this mode of securing small sums has been latterly considerably diminished, from the discovery, that though the interest payable is secured by act of parliament, yet the management, being lodged in the hands of private individuals who undertake it ostensibly from benevolent motives, is under no effective check beyond that of the general character of the directors. Several instances have occurred of losses to a considerable amount, from the negligence or misconduct of the managers. The following

Statistics. tables show the progress of the system as far as can be ascertained by public documents; the first showing the gross amount of deposits and deductions to the latest return published; the latter the rates of the deposits at two periods, by which not only the progress of the system, but the proportional number of contributors of different pecuniary means, may be conjectured.

Amount of Lodgments and Deductions in Savings Banks from their first Formation.

Years.	Lodged.	Drawn out.	Excess of Lodgments.	Deficiency of Lodgments.
1821	L.46,615	L.25,200	L.21,415	...
1822	82,338	8,030	74,308	...
1823	123,230	11,723	111,507	...
1824	175,292	17,538	157,754	...
1825	207,738	35,047	172,691	...
1826	156,249	87,085	69,164	...
1827	139,080	164,939	...	25,859
1828	254,400	134,608	119,792	...
1829	311,600	179,002	132,598	...
1830	213,020	221,769	...	8,749
1831	288,875	316,819	...	27,944
1832	272,193	193,467	78,726	...
	L.2,270,630	L.1,395,227	L.937,955 62,552	L.62,552
Remaining in bank to the credit of the depositors in 1832			L.875,403	

Comparative Statements of Deposits in Savings Banks in 1830 and 1833.

Depositors.	1830.		1833.	
	Number of Depositors.	Amount of Deposits.	Number of Depositors.	Amount of Deposits.
Under L.20	17,360	L.116,818	23,600	L.173,525
50	11,141	333,160	18,262	550,557
100	4,443	287,725	5,579	367,161
150	961	111,693	1,242	148,432
200	230	38,511	419	70,840
Above 200	66	17,149	68	16,607
Total.......	34,201	L.905,056	49,170	L.1,327,122

Roads. The internal traffic of the country is carried on chiefly by wheel-carriage roads. Canals are few, and railways almost unknown. The great roads are mostly kept up by turnpikes, against which there was, until lately, a violent and just outcry, as the outlay upon them did not at all correspond with the amount of tolls collected. Latterly most of them have been placed under the control of the post-office, which lets them out to contractors. Their condition, both as to lines of direction and mode of construction, is excellent. The limestone, which is the general substratum of the greater part of the country, is the best material for their formation; and the system now so generally known and highly appreciated under the name of macadamizing was long and successfully practised in many of the leading lines of road in Ireland before it was thought of in Great Britain. Young remarks upon this peculiarity as early as the year 1779. "For a country," says he, "so very far behind us as Ireland to have got so suddenly the start of us in the article of roads, is a spectacle that cannot fail to strike the English traveller exceedingly. I will go here; I will go there; I could trace a route upon paper as wild as fancy could dictate, and everywhere I found beautiful roads, without break or hindrance, to enable me to realize my design. But from this commendation the turnpikes in general must be excluded; they are as bad as the cross roads are admirable." The cause of this eulogy is to be traced to acts made on the subject from the time of Charles I. till the beginning of the reign of George III. Before that time the roads were constructed and repaired, like those in England, under the miserable police of the six days' labour. The new law totally changed the arrangement. The system according to which the cross roads, or, as they are called, the presentment roads, are made, is this: The part to be acted upon is measured by two persons, who swear to the measurement, to their opinion of its utility, and to its probable expense. A certificate to this effect is signed by the measurers, the overseers who propose to undertake the work, and the justice before whom the oath is taken. It is then sent in to the grand jury at the assizes, and if approved there, the work is undertaken by the overseers at their own expense, and must be finished before the ensuing assizes, when, on a certificate upon oath that the money has been honestly expended, it is passed by the grand jury, fiated by the judge of assize, and paid forthwith by the county treasurer. In like manner, bridges, jails, houses of correction, and other public works, are built. The expense is defrayed by a tax on the lands, paid by the occupying tenant, either by the acre or by the plough-land or town-land. In the latter case, as these denominations are of very unequal dimensions, the tax falls very unfairly upon the holders of the land. The restriction upon a wanton outlay of money, either in consequence of an unnecessary line of road, or an exorbitant estimate of expense, is by traversing, or opposing, the presentment in the first case, that is, by denying the allegations in the certificate. The presentment is then laid by till the ensuing assizes, and in the intermediate time inquiries are made respecting the conflicting statements. In the latter case, payment is suspended until the case is cleared up and proved. The good effects of this system rest upon the principle, that when individuals act for the public alone, the public is likely to be negligently, and therefore badly served; but when their own interest as well as that of the public is concerned, good is likely to be done. For a few years after the passing of the act, the good roads were found all leading from the mansions of the principal gentry in the counties, as rays from a centre, with a surrounding space through which there was no communication; but every year brought the remedy, until in a short time those rays, proceeding from so many centres, met, and the communication was complete. At first, roads were, like bridges, paid out of the common stock of the county, but afterwards they were charged upon the barony through which they were made. By subsequent acts, narrow mountain roads, and foot-paths along the sides of the greater roads, were constructed upon the same principle. The exorbitancy of expense, arising from the power of imposing the tax having been vested in the hands of the great landed proprietors as grand jurymen, whilst the payment came out of the pocket of the poor occupier, was the less felt, except in some extreme cases, because the money was expended among those who paid it, and gave employment to many hands that otherwise would have been pining away in idle destitution. Still, however, it must be acknowledged, that complaints against what is called jobbing were, and still continue to be, general, and too often upon solid grounds.

Inland navigation, &c. With respect to canals, the manner in which Ireland is circumstanced in this respect may be most fairly estimat-

Statistics.

ed by a view of the following table, which exhibits the relative proportion, or rather disproportion, of the means of internal communication, by means of inland navigation and railways, in that country and in England.

	Ireland.	England.
Acreable contents	20,499,500	37,094,960
Population in 1831	7,734,365	16,537,398
Canals......miles	280	2400
Navigable rivers.....miles	380	2000
Railways......miles	$5\frac{3}{4}$	400

The idea of improving Ireland by means of inland navigation is attributable to the unfortunate and misguided Earl of Strafford, who had the sagacity to perceive that the general flatness of the country, and the abundance of lakes, waters, and bog, were very favourable to it. Yet no parliamentary steps are on record respecting the subject until 1703, when bills were brought in to make the Shannon navigable from Limerick to Jamestown in Leitrim, for the rivers Barrow and Boyne, and for connecting Newry with Lough Erne. No further steps were taken till 1709, when the subject was revived. In 1715 a company for rendering the Shannon navigable was formed, under an act which also gave general powers for similar undertakings elsewhere. Many projects were started under the provisions of this act. The following is a summary of their results:

1. From Dublin to Banagher on the Shannon; accomplished by the Grand Canal.
2. The Barrow, with a canal thence to join the Grand Canal; accomplished.
3. The Glyn and Bann, from Newry to Coleraine; effected as far as Lough Neagh by the Newry Canal.
4. The Nore and Brosna, from New Ross to the Grand Canal; unaccomplished.
5. The Liffey and Greece, from Dublin to Carlow; partially effected by the Kildare branch of the Grand Canal.
6. The Blackwater, from Youghal to Newmarket; effected as far as Lismore.
7. The Foyle, Finn, Derg, and Mourne, from Derry to Omagh; effected to Strabane.
8. The Boyne, from Drogheda to the Grand Canal; the river made navigable to Navan.
9. The Suir, from Waterford to Thurles; a towing-path made to Clonmell.
10. The Lee, from Cork to Macroom; some locks made, but to no purpose.
11. The Erne, above Lough Erne; unattempted.
12. The Maig, from Limerick to Cork; unattempted.
13. A line from Sligo to Carrick-on-Shannon; unattempted.
14. A line through Lakes Corrib and Mask, from Galway to Killala; unattempted.
15. The Slaney, from Wexford to Baltinglas; unattempted.
16. A line from Galway to the Shannon; unattempted.
17. The Inny, from Lough Shillin to the Shannon; unattempted.
18. The Suck, from Castlerea to the Shannon; unattempted.
19. The Bandon, from Kinsale to Dunmanway; unattempted.
20. The Laune, from Newcastle to Castlemaine; unattempted.

After a lapse of fourteen years, it was found that works of such magnitude could not be carried into effect without public aid; a fund was therefore formed by parliament from taxes on wheel-carriages, cards, dice, and wrought plate. The amount of the income thence arising amounted in 1735 to L.3000 per annum, in 1740 to L.4000, and in 1750 to L6000. For nineteen years the whole fund was applied to the navigation from Newry to the Tyrone collieries. The committee for the improvement of tillage having reported that inland navigation was the most effectual means for its increase, the lines of the present Grand and Royal Canals were struck out, but the public money was applied solely to the former of these. In 1771 the board of inland navigation was empowered to transfer the property of any canal in progress to a local company which would subscribe towards its completion; and several additional grants of money were made in aid of such companies; but in 1789 it was found that the board had involved itself in debt to the amount of upwards of L.26,000, whereupon it was dissolved, the payment of debts secured by debentures, and the navigations transferred to local commissioners. In the same year parliament resolved to grant one third of the expense to any new undertaking of this kind; and from thence to the union many large grants were made on this principle. The two great canal companies, during the same period, were induced to undertake an expensive system of wet docks in Dublin, which greatly embarrassed their funds, without a prospect of adequate remuneration. At the union, L.500,000 were granted for inland navigation generally, and for some specific lines of works, to be under the control of a board. Since that period to 1812, L.213,000 were further granted to them. The principal objects of expenditure were the Grand and Royal Canals, the Shannon and the Barrow Rivers, the Newry and Tyrone Canals. The board has also, since 1810, caused several surveys to be made of lines between the Shannon, Barrow, Suir, and Grand Canal, and also towards Loughs Erne and Neagh. Various minor lines have likewise been pointed out, in consequence of the general survey of the bogs; so that it may truly be said, that a more perfect knowledge of the levels and waters of Ireland has been obtained than of any other country in the world except Holland.

To proceed to some of the details of the works that have been completed: The Grand Canal commences near the embouchure of the Liffey, where it has floating docks with sixteen feet depth of water, and capable of containing 400 sail of vessels, with three entrance-locks, and three graving-docks. It sweeps round thence by the southern verge of the city westward for eighty miles, to the Shannon at Banagher, with branches to the Barrow at Athy, and some minor ones. The summit-level is 240 feet above the level of the sea, and 160 above the Shannon. The commodities conveyed on it are flour, grain, potatoes, turf, coal, manure, brick, stone, flags, slates, and assorted merchandise. Its revenue in 1813 amounted to L.90,000, but since the peace it has diminished considerably. A branch of this canal was carried on westward of the Shannon to Ballinasloe in 1828, being a distance of fifteen and a half miles.

The Royal Canal extends from Dublin westward to the Shannon, nearly parallel to the Grand Canal, and for a long part of its course seldom more than ten miles distant from the latter. It begins on the north side of the Liffey, with which it communicates by a sea-lock, opening into a floating-dock capable of containing twenty-seven sail of shipping; and thence by the Broadstone, where there is a harbour, to Tarmonbarry in Longford; its total length being eighty-eight miles. The summit-level is 307 feet above the sea. The company by which this navigation was undertaken having become insolvent, it lapsed into the hands of government, by whom it has been completed and rendered available. The principal commodities conveyed by it are grain, meal, flour, butter, potatoes, turf, timber, bricks, and stone. In 1828, during a severe scarcity of potatoes in Leinster and the south of Ireland, whilst there was a superabundance in Connaught, 22,292 tons were brought to Dublin from the latter province by the Royal Canal, which greatly alleviated the distress of the poor in the other parts. The general tonnage on these two main canals has been as follows:—

Years.	Grand Canal.		Royal Canal.	
	Tonnage.	Amount of Toll.	Tonnage.	Amount of Toll.
	Tons. Cwts.	L. s. d.	Tons.	L. s. d.
1821	142,622 ...	32,517 13 10½	108,933	8,654 17 4
1822	134,939 ...	24,866 4 9	80,366	9,903 8 2
1823	143,147 ...	24,058 6 7	75,273	7,306 19 5
1824	166,749 ...	27,679 7 3	84,887	6,843 10 5
1825	188,731 ...	32,328 7 1	119,262	7,717 5 0
1826	189,686 ...	28,408 16 4	127,884	10,842 0 9
1827	179,173 ...	33,587 4 9½	145,519	11,624 17 2
1828	190,387 ...	35,212 19 0½	213,774	13,229 14 4
1829	191,774 ...	31,435 15 8½	154,001	19,434 14 3
1830	224,749 10	33,464 8 0½	140,019	13,091 3 11
1831	237,809 15	36,735 12 3	129,844	12,729 6 1

Of the lesser artificial lines of inland navigation, the Newry Canal is the most important, and was the first completed. It is navigable from the tideway at Fathom, to Newry, for vessels of nine or ten feet draught; and thence to the Bann, where that river becomes navigable for barges of sixty tons. Its summit is sixty-five feet above the sea. The navigation is carried on in the Bann for twelve miles to Lough Neagh, which is navigable through an extent of fifteen miles by eleven. The Lower Bann, from Lough Neagh to the sea below Coleraine, is yet unnavigable, from obstructions in its course.

The Lagan navigation extends from the tideway at Belfast, partly in the river, partly artificially, to Lough Neagh, a distance of twenty miles. It is the only undertaking of the kind which has been maintained by local taxes, assessed upon the neighbouring districts at their own request.

The Tyrone Colliery Canal extends from Coal Island in Tyrone, four miles to the Blackwater, and thence by a short cut into Lough Neagh, which thus forms the receptacle for three branches of inland navigation. The communication from the colliery basin to the mines is by a wooden railway.

A new line of inland navigation, under the name of the Ulster Canal, is now in progress. Its object is to connect Loughs Neagh and Erne. The workings have been carried on from the former of these points to Tullybrick Lake in Armagh.

The river navigation, commencing from Dublin, may be summed up as follows: The Liffey is navigable merely to the western extremity of Dublin city, and that only from half flood. The Slaney is navigable for barges from Wexford to Enniscorthy, a distance of nineteen miles. On the southern side of the island, the Barrow has been rendered navigable from the tideway at the Scars, below St Mullins, to Athy, a distance of forty-three miles; the total fall is 172 feet. It is partly a river, partly a still water navigation. The Nore, a branch of the Barrow, is navigable for barges from New Ross to Thomastown. The Suir, another branch, admits vessels of the largest draft at Waterford, and thence is navigable for sloops to Carrick, and for barges to Clonmell. The southern Blackwater admits vessels of 300 tons over its bar, and sloops can proceed eight miles up the river to Dromore. A navigable canal has been cut by the Duke of Devonshire, from Cappoquin to Lismore, three miles. Three miles of canal were also made above Mallow. The Lee admits vessels of 200 tons as far up as the city of Cork, and barges a short distance farther. The Bandon is navigable from Kinsale to within three miles of Bandon. On the western coast, the Laune and Main in Kerry uniting, fall into the head of Dingle Bay. They admit sloops to Castlemaine. The noble river of the Shannon, which, if properly treated and cleared of its impediments, might be called the great aorta of Ireland, is navigable, but with frequent interruptions, from Limerick, for 230 miles. The Maig, one of its branches, admits boats as far as Adare; and the Fergus, which discharges itself into its estuary, has been rendered navigable for boats as far as Ennis. The Moy, in Mayo, admits small vessels from Killala to Ballina. The only navigable river on the northern coast is the Foyle; it is navigable by nature for nine miles to St Johnstown, and thence by the assistance of art for four miles farther to Strabane. Proceeding north about to the eastern coast, the only river to the north of Dublin is the Boyne, in which, by the attention paid to clear its channel, vessels of considerable burden can run up as far as Drogheda, four miles from its mouth. The navigation is continued thence for boats in the bed of the river to Slane, and beyond that by artificial means sixteen miles further, to Navan and Trim. The total ascent from the former to the latter of these places is 190 feet. The following table affords a summary view of the length of the chief lines of inland navigation, and of the expense at which they have been formed.

Comparative Rates of Expense per Mile, of the several Navigations in Ireland, with Rate of Lockage on each respectively.

Denomination.	Length.	Lockage.	Cost per Mile.	Total Cost.	
	Miles.	Feet.	L.	L.	
Grand Canal	100	$5\frac{1}{3}$	18,610	1,861,008	
Royal Canal	72	$7\frac{1}{2}$	19,749	1,421,955	
Limerick Navigation	12	7	10,297	123,560	Six and a half miles still water, five and a half river navigation.
Barrow Navigation	34	5	7,220	255,502	Five miles still water, twenty-nine river navigation.
Boyne Navigation	$15\frac{1}{2}$	$5\frac{5}{6}$	7,463	115,678	Partly still water, partly river navigation.
Lagan Navigation	22	$8\frac{1}{3}$	4,363	96,000	

Statistics.

Besides these river navigations, and that of Lough Neagh already noticed, Lough Corrib is navigable from Galway for boats for nearly fifty miles. The chief trade is in turf, lime, and grain to Galway. The Erne becomes navigable at Belturbot, whence there is a navigation through the lakes, but obstructed at the gut of Enniskillen by weirs. The free passage from the lakes to the sea is prevented by the salmon weirs at Ballyshannon.

The only rail-road is that between Dublin and Kingstown, a distance of five miles and three quarters. It is formed on the model of that between Liverpool and Manchester. It was opened in 1834, and promises to be very productive, chiefly by the conveyance of passengers. Its shares are at a premium of upwards of a hundred per cent.

Cattle trade, &c.

The cattle trade is chiefly transacted at fairs, of which by far the most important is held at Ballinasloe in Connaught. There are two annual fairs; that of October regulates the transactions as to live stock in black cattle and sheep for the ensuing year. The extent of dealings can be estimated by the subsequent tables. The sheep and heifers sent thither are from three to four years old, the bullocks from four to five. The latter are mostly lean, and are kept for a year on the rich pastures of Leinster before they are thought fit for the Dublin or Liverpool market. The decline in the number of cattle and sheep in the latter years, stated in the table, is attributed partly to the increase of tillage cultivation, caused by the great increase of the population, and the consequent continual subdivision of land, and partly to the increased demand for cattle and sheep in several other fairs.

Number of Sheep and Black Cattle Sold and Unsold at the October Fairs at Ballinasloe, for every Fourth Year from 1790 to 1834 both inclusive.

Years.	Sheep.			Black Cattle.		
	Sold.	Unsold.	Total.	Sold.	Unsold.	Total.
1790	59,231	2,700	61,931	7,782	850	8,632
1794	64,580	2,895	67,475	7,106	231	7,337
1798	64,700	9,451	74,151	6,931	700	7,631
1802	75,927	8,571	84,498	6,232	3,512	9,744
1806	64,222	23,171	87,393	5,158	7,032	12,190
1810	69,481	21,520	91,001	5,331	1,727	7,258
1814	72,678	7,602	80,280	3,748	5,863	9,611
1818	65,585	5,292	70,877	6,354	3,256	9,610
1822	74,718	15,497	90,177	5,322	3,695	9,017
1826	57,808	36,597	94,405	4,393	3,844	8,240
1830	66,874	14,611	81,485	5,894	1,563	7,457
1834	57,810	8,904	66,714	7,521	2,116	9,637

The traffic in cattle slaughtered for exportation is transacted in the towns in which the trade is carried on, whither the animals are sent from great distances. The principal marts are Cork, Limerick, Waterford, and Belfast. The corn sold is either purchased by factors or sent to the mills in the neighbourhood, where it is ground and disposed of for domestic consumption or for export. The extent and progress, both of the provision and corn trade, will best be ascertained in the tables of exports under a subsequent division of this article. The linen trade is carried on chiefly at the weekly markets held in the larger towns of the northern province, to which the manufacture is mostly confined.

Trade and commerce.

The external trade of Ireland branches out into two great divisions, the cross-channel trade with Great Britain, and the commerce with foreign nations. The progress of domestic navigation will appear best from the first of the following tables, containing a summary, in periods of ten years each, of the number and tonnage of ships built in Ireland, and of the number and tonnage of those belonging to the several ports of Ireland; while the relative importance of each port, as respects its commercial character, will appear from the second, which contains a specification of the number of vessels registered in each of the ports of Ireland in each of the years specified.

Statement of the Number and Tonnage of vessels Built in Ireland, and of the Number and Tonnage of those that belong to the several Ports there, arranged in totals of Ten Years.

Years.	New Vessels.		Vessels Registered.	
	Vessels.	Burthen.	Vessels.	Burthen.
	No.	Tons.	No.	Tons.
1787 to 1797	458	20,576	11,171	633,659
1797 to 1807	286	15,289	10,428	550,959
1807 to 1817	372	17,616	11,467	604,953
1817 to 1827	484	21,252	12,184	659,352
1827 to 1834	295	17,396	10,107	736,850

Statistics.

Number of Vessels Registered at each of the Irish Ports in every Year specified.

	1791.		1801.		1811.		1821.		1825.	
	Ships.	Tons.	Ships.	Tons.	Ships.	Tons.	Ships.	Tons.	Ships.	Tons.
Ballimore	47	1,623	39	1,248	67	2,104	85	2,356	76	2,309
Belfast	61	6,245	51	4,539	77	8,365	123	11,631	153	15,142
Coleraine	17	569	13	409	13	426	15	664	5	114
Cork	121	9,704	75	5,376	88	5,682	95	5,566	83	5,425
Donaghadee	28	777	23	783	27	1,068	40	1,375	44	1,589
Drogheda	19	959	15	861	20	1,178	31	1,840	34	2,210
Dublin	243	16,051	251	17,450	207	11,948	251	14,578	272	18,132
Dundalk	7	433	10	755	2	248	1	137	6	381
Galway	58	2,286	29	715	42	1,699	16	703	14	423
Killibegs	34	2,052	10	419	13	329	10	161	11	436
Kilrush	...	...	...	...	...	...	2	68	11	310
Kinsale	50	1,883	57	2,010	67	2,316	96	3,473	84	2,987
Larne	35	1,548	33	1,286	40	1,440	44	1,505	44	1,364
Limerick	17	1,158	33	1,485	49	2,110	41	1,653	36	1,372
Londonderry	31	1,317	16	1,150	12	1,127	18	2,084	20	2,606
Newport	11	727	4	120	2	55	3	70	5	108
Newry and Strangford	83	4,865	84	3,631	132	6,411	171	7,386	182	8,651
Sligo	13	546	9	376	11	296	20	1,160	7	255
Tralee	7	297	8	200	12	356	10	298	13	404
Waterford and Ross	60	4,633	42	2,727	27	2551	30	2,795	36	3,623
Westport	...	...	...	...	...	...	...	...	...	...
Wexford	54	2,253	62	2,704	70	3,271	74	3,717	85	4,552
Wicklow	39	1,558	18	685	32	1,049	41	1,331	43	1,387
Youghal	136	5,926	119	5,310	119	5,155	124	4,194	127	5,253
Ireland	1,176	69,233	1,003	54,232	1,133	59,155	1,345	69,036	1,391	80,583

The progress of the general navigation of Ireland with other countries may be inferred from the following table, which also affords a view of the outlets for Irish commerce at the periods specified. The official returns previously to the union do not state the number or tonnage of the vessels which cleared out from Ireland for foreign parts. What has been published is sufficient, however, to show the great preponderance of the trade with Great Britain over that with all the world besides. The accounts could not be stated according to any cycle of years, in consequence of a chasm in the official documents from 1806 to 1817.

Number of all Vessels, British, Irish, and Foreign, entered inwards into Ireland.

	1795.	1800.	1806.	1817.	1821.	1825.
Russia	70	28	54	30	30	82
Sweden	73	51	45	17	9	9
Denmark and Norway	264	237	420	114	91	193
Prussia	72	78	14	18	38	72
Germany	5	19	10	6	2	1
Netherlands	46	11	47	26	30	61
France	2	17	7	16	21	18
Portugal	106	132	98	96	79	110
Spain	53	44	49	60	71	39
Italy	10	5	10	16	20	41
Turkey	...	...	...	1	1	5
United States	107	128	130	97	60	59
West Indies, Foreign	11	5	...	1	...	1
West Indies, British	38	25	36	45	69	74
British North Colonies	19	12	29	109	165	277
Asia	...	...	1	5	...	...
Africa	...	...	...	...	2	2
Total from all the world except England	893	846	1,100	755	795	1,116
From England	6,193	6,852	7,837	9,790	9,523	11,542
General Total	7,086	7,298	8,936	10,545	10,318	12,658

The preponderance of the trade with England over that with all the rest of the world is still further illustrated by the following tables of imports and exports, which also exhibit a view of the principal articles, both of the cross-channel and foreign trade, and of the increase or diminution of the several articles of which it consists:—

Imports into Ireland from all Parts, for the year 1801, *and for every Fourth Year since, during the period for which such Accounts can be made up.*

	1801.	1805.	1809.	1813.	1817.	1821.	1825.
Ashes, pearl and pot, and barilla.......cwts.	75,914	122,412	214,293	87,712	100,976	132,516	112,836
Flax-seed..................................bush.	376,985	234,014	262,748	292,313	237,566	375,346	535,331
Timbers and deals................great hund.	14,461	22,169	3,976	12,672	4,592	4,155	9,389
——— staves....................great hund.	31,213	41,979	56,327	20,581	43,041	24,611	43,457
——— 8 inch square and upwards....loads	13,483	21,973	18,662	29,473	19,845	30,928	76,049
Iron unwrought...........................tons	7,454	15,140	14,149	23,231	12,457	16,016	17,902
—— wrought, hardware and cutlery...value	L.144,812	L.195,348	L.266,447	L.357,735	L.175,355	L.231,012	L.264,944
Haberdashery..............................value	L.57,626	L.83,255	L.130,939	L.155,199	L.77,497	L.93,550	L.337,208
Woollens, entered by the yard.........yards	2,095,258	2,489,516	3,426,859	4,498,431	2,315,558	2,670,770	3,384,918
——— of other kinds...................value	L.41,144	L.85,504	L.72,032	L.118,460	L.49,218	L.130,910	L.43,733
Woollen and worsted yarn.................lbs.	17,181	48,638	533,995	1,342,933	653,248	777,711	579,051
Cottons, entered by the yard............yards	44,314	59,904	205,110	214,783	541,900	968,369	4,996,885
——— of other kinds......................value	L.152,406	L.214,782	L.238,101	L.254,709	L.176,072	L.234,482	L.30,933
——— yarn....................................lbs.	375,597	1,459,905	1,114,879	1,684,828	813,875	2,336,206	2,702,523
——— wool....................................lbs.	1,200,192	1,874,236	5,576,088	3,378,144	2,472,554	3,967,363	4,065,930
Silk, raw and thrown.......................lbs.	60,034	88,457	82,415	104,186	60,069	58,729	62,128
Coffee...lbs.	283,780	203,357	589,316	991,144	739,508	243,425	335,921
Spirits—Brandy and Geneva......imp. gals.	379,438	26,093	184,238	34,670	4,134	21,749	9,166
——— Rum.......................imp. gals.	1,152,828	138,783	1,196,044	487,347	124,458	33,005	33,295
Sugar, raw...................................cwts.	296,258	253,462	369,049	318,153	245,012	307,945	280,634
—— refined..................................cwts.	4,209	23,231	18,510	20,106	28,204	42,139	66,392
Tea..lbs.	3,499,801	3,267,712	3,391,663	3,522,942	3,141,035	3,493,960	3,889,658
Tobacco.......................................lbs.	6,941,946	5,480,022	8,047,052	2,520,555	4,465,790	2,714,594	3,904,034
Wines...................................imp. gals.	1,172,166	962,984	1,316,104	941,431	386,458	548,279	968,940
Tallow......................................cwts.	21,188	30,400	5,391	19,514	13,397	59,242	186,147
Coals...tons.	315,345	412,515	402,040	517,047	712,988	651,909	738,453
Other articles..............................value	L.1,099,767	L.1,182,866	L.1,709,099	L.1,903,441	L.1,690,072	L.1,571,925	L.2,021,973
Total.........................official value	L.4,621,345	L.5,294,967	L.6,896,822	L.7,797,287	L.5,646,563	L.6,407,428	L.8,596,785

Exports from Ireland to all Parts, for the year 1801, and for every Fourth Year since, during the period for which Accounts can be made up.

	1801.	1805.	1809.	1813.	1817.	1821.	1825.
Produce or Manufactures of the United Kingdom.							
Grain—Barley........quarters	......	17,223	26,588	194,193	39,114	78,228	154,822
Oats........ditto	129	233,234	828,458	808,329	646,036	1,159,824	1,503,204
Wheat........ditto	......	82,815	85,599	201,273	57,280	476,940	283,340
Other grain........ditto	1	5,302	3,023	5,934	2,011	7,897	23,832
Wheat flour........cwts.	203	22,774	18,087	267,894	34,517	295,035	394,507
Oatmeal........ditto	2,524	34,297	90,948	108,547	34,863	66,063	204,617
Cattle—Black........number	31,664	21,941	18,335	49,592	45,322	26,759	63,524
Sheep........ditto	2,891	10,988	7,596	7,690	29,478	25,354	72,191
Swine........ditto	1,968	6,383	4,712	14,521	24,418	104,556	65,919
Horses........ditto	818	4,186	3,451	4,001	879	2,503	3,140
Bacon and hams........cwts.	21,161	95,073	167,122	234,606	191,025	366,209	362,278
Beef and pork........barrels	160,840	222,098	262,744	281,503	262,605	219,165	181,276
Butter........cwts.	304,666	294,415	385,953	461,514	397,965	472,944	474,162
Lard........ditto	2,049	6,363	16,282	20,136	17,181	28,489	35,261
Soap and candles........ditto	15,557	17,713	30,810	46,615	25,381	18,454	14,791
Flax, undressed........ditto	1,639	278	6,507	69,191	44,239	68,791	54,898
Spirits, Irish........imperial gallons	178,602	819,970	60,437	113,316	37,884	326,491	629,529
Cottons, entered by the yard........yards	1,256	8,956	34,998	99,141	549,261	921,971	10,567,458
Ditto of other kinds........value	L.4,842	L.3,281	L.31,923	L.58,074	L.26,250	L.6,564	L.301
Linens........yards	37,911,602	43,683,533	37,166,399	39,023,087	56,230,575	49,531,139	55,114,515
Linen yarn........lbs.	2,631,132	792,400	1,534,512	2,141,776	1,571,444	1,150,464	391,480
Other articles........value	L.192,259	L.211,184	L.302,843	L.280,999	L.434,125	L.334,323	L.466,300
Total........official value	L.3,378,145	L.4,670,647	L.4,992,841	L.6,297,264	L.6,447,424	L.7,705,071	L.9,101,956
Foreign and Colonial Merchandise.							
Coffee........lbs.	218,876	155,484	237,706	765,072	147,168	4,088	14,814
Brandy and Geneva........imperial gallons	133,068	5,730	28,161	95,851	816	17,625	6,648
Rum........ditto	57,278	19,942	136,426	332,140	74,017	16,217	35,807
Sugar, raw........cwt.	122	301	2,738	5,987	324	391	28,252
Tobacco........lbs.	1,621,353	690,986	511,767	600,694	443,798	719,275	1,118,926
Wines........imperial gallons	148,769	82,612	137,386	260,903	170,482	54,494	64,995
Other articles........value	L.155,624	L.72,555	L.210,765	L.196,612	L.53,757	L.36,957	L.32,449
Total........official value	L.286,400	L.131,521	L.305,477	L.402,993	L.150,562	L.77,805	L.141,254
General total........official value	L.4,064,545	L.4,802,168	L.5,298,318	L.6,700,257	L.6,597,987	L.7,782,875	L.9,243,210

Summary View of the Official and Real Value of the Imports and Exports of Ireland, to and from Great Britain, Foreign Parts, and all Parts, for the year 1801, *and every Fourth Year to* 1829 *inclusive, in Pounds Sterling.*

		1801.	1805.	1809.	1813.
Official value of imports into Ireland from..........................	Great Britain..	L.3,270,351	L.4,067,717	L.5,216,557	L.6,746,354
	Foreign parts..	1,350,994	1,227,250	1,580,265	1,050,933
	All parts........	L.4,621,345	L.5,294,967	L.6,896,822	L.7,797,287
Official value of exports from Ireland, being the produce of the united kingdom, to...............	Great Britain	L.3,352,069	L.4,201,077	L.4,367,425	L.5,164,483
	Foreign parts	426,076	469,570	625,416	1,132,781
	All parts	L.3,778,145	L.4,670,647	L.4,992,841	L.6,297,264
Official value of exports from Ireland, being foreign and colonial merchandise, to.............	Great Britain..	L.185,656	L.87,090	L.220,880	L.245,844
	Foreign parts..	100,744	44,431	84,597	157,149
	All parts........	L.286,400	L.131,521	L.305,477	L.402,993
Official value of the total exports from Ireland to....................	Great Britain..	L.3,537,725	L.4,288,168	L.4,588,306	L.5,410,327
	Foreign parts..	526,820	514,001	710,012	1,289,931
	All parts.......	L.4,064,545	L.4,802,169	L.5,298,318	L.6,700,258
Real value of the produce of the united kingdom exported from Ireland to.........................	Great Britain.	Not recorded.	Not recorded.	L.9,260,783	L.11,228,401
	Foreign parts..	...	...	1,321,616	2,467,824
	All parts........	...	...	L.10,582,399	L.13,696,225

		1817.	1821.	1825.	1829.
Official value of imports into Ireland from..........................	Great Britain..	L.4,722,766	L.5,338,838	L.7,048,936	...
	Foreign parts..	923,797	1,068,590	1,547,849	L.1,669,406
	All parts.......	L.5,646,563	L.6,407,428	L.8,596,785	...
Official value of exports from Ireland, being the produce of the united kingdom, to...............	Great Britain..	L.5,569,465	L.7,067,252	L.8,404,288	...
	Foreign parts.,	877,960	637,818	697,668	L.747,515
	All parts........	L.6,447,425	L.7,705,070	L.9,101,956	
Official value of exports from Ireland, being foreign and colonial merchandise, to.............	Great Britain..	L.127,149	L.50,200	L.127,067	...
	Foreign parts..	23,413	27,605	14,187	L.15,964
	All parts.......	L.150,562	L.77,805	L.141,254	...
Official value of the total exports from Ireland to....................	Great Britain.	L.5,696,614	L.7,117,452	L.8,531,355	...
	Foreign parts..	901,373	665,424	711,855	L.763,480
	All parts........	L.6,597,987	L.7,782,876	L.9,243,210	...
Real value of the produce of the united kingdom exported from Ireland to.........................	Great Britain..	L.9,114,428	L.8,974,510	...	...
	Foreign parts..	1,411,897	832,135	L.793,615	L.617,596
	All parts........	L.10,526,325	L.9,806,645	...	...

Another view of this interesting illustration of the importance and value of the commercial ties which connect together these two great portions of the united kingdom, may be had from the following tables, the two first of which exhibit the number of vessels that entered and quitted the ports of Ireland during the period therein mentioned; the third shows the progressive increase of the interchange of the commodities of both islands by the cross-channel trade.

Vessels entered Inwards into Ireland.

Years.	British and Irish Vessels.				Foreign.		Total.	
	From Great Britain.		All other Parts.		From all Parts.		Inwards.	
	Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.
1814	9,487	794,684	472	57,476	283	52,427	10,242	904,677
1815	9,313	700,224	491	59,291	494	90,875	10,800	942,864
1816	8,997	696,153	565	70,106	318	67,538	10,203	902,476
1817	9,883	796,238	504	63,577	244	43,175	10,890	954,012
1818	9,525	769,544	574	73,511	376	64,727	10,475	907,782
1819	10,391	885,120	698	95,994	412	72,746	11,501	1,023,869
1820	9,644	809,076	530	74,986	237	42,532	10,410	926,601
1821	9,929	845,000	597	83,165	198	33,373	10,724	961,535
1822	10,618	997,769	643	89,383	300	53,183	11,561	1,040,355
1823	10,052	825,889	573	72,523	311	54,276	10,936	952,688
1824	10,987	945,383	607	91,594	375	64,792	11,969	1,101,769
1825	11,542	984,754	696	115,848	420	66,711	12,658	1,167,313
1826	11,514	1,037,299	850	154,380	290	50,194	12,654	1,241,873
1827	10,850	1,045,528	672	114,118	226	36,040	11,748	1,195,686
1828	12,158	1,139,241	849	138,809	184	30,523	13,291	1,308,573
1829	13,278	1,292,041	903	150,681	190	28,255	14,971	1,470,977
1830	13,339	1,242,501	821	143,951	147	22,531	14,307	1,407,983
1831	13,584	1,262,221	740	130,876	175	27,285	14,499	1,420,382
1832	14,772	1,384,898	823	156,934	111	17,651	15,706	1,559,483
1833	14,474	1,399,868	848	167,932	136	22,198	15,462	1,589,998
1834	14,816	1,469,254	824	152,156	139	22,188	15,830	1,643,598

Vessels cleared Outwards from Ireland.

Years.	British and Irish Vessels.				Foreign.		Total.	
	From Great Britain.		All other Parts.		From all Parts.			
	Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.	Vessels.	Tonnage.
1814	9037	730,357	685	111,268	179	32,817	9,901	883,432
1815	9552	736,011	513	69,325	418	80,042	10,483	935,648
1816	8638	712,620	522	74,255	321	69,703	9,481	856,578
1817	9186	770,547	489	71,900	234	45,073	9,909	887,520
1818	9278	752,020	514	78,120	337	63,229	10,129	893,370
1819	9905	823,191	577	94,647	348	64,636	10,830	982,474
1820	9229	783,750	466	76,561	230	42,337	9,925	902,648
1821	9440	819,648	439	65,782	182	32,936	10,061	918,366
1822	9562	832,927	522	80,661	261	49,125	10,345	962,713
1823	9382	786,637	426	63,384	258	47,797	10,066	897,818
1824	7534	615,396	413	70,317	308	56,355	8,255	742,068
1825	8922	741,182	440	82,673	332	54,712	9,694	878,567
1826	6388	632,972	569	117,032	281	51,334	7,238	801,338
1827	7411	737,752	515	102,906	209	75,340	8,135	875,998
1828	8790	925,505	516	95,717	150	26,455	9,456	1,045,677
1829	8922	906,159	571	109,142	152	24,161	9,645	1,039,461
1830	8455	880,965	553	113,087	137	22,161	9,145	1,016,213
1831	9029	821,128	613	126,222	159	26,195	9,801	1,073,545
1832	9374	970,481	579	129,393	82	12,878	10,035	1,112,751
1833	9270	1,001,808	617	136,924	92	14,911	9,979	1,153,643
1834	9796	1,061,766	558	118,369	100	16,386	10,454	1,196,521

Average Amount of Imports and Exports between Great Britain and Ireland.

	Imports into Ireland.	Exports to Great Britain.
1749 to 1759, ten years	L.1,015,305	L.1,274,569
1759 to 1769, ten years	1,367,573	1,719,575
1769 to 1779, ten years	1,823,183	2,405,747
1779 to 1789, ten years	2,286,562	2,710,039
1789 to 1799, ten years	L.2,923,321	L.3,816,018
1799 to 1809, ten years	4,317,828	4,114,704
1809 to 1819, ten years	4,787,434	5,722,242
1819 to 1825, five years	5,046,389	6,450,803

The imports may be considered as almost wholly intended for home consumption, either as materials of manufacture, or for the immediate use of the people, as the quantities imported for re-exportation, though increasing

Statistics. of late, bear a very small proportion to their total amount. The principal articles imported in a raw or unwrought state are, coal, iron, flax-seed, flax, hemp, ashes, cotton wool, timber, deals, staves, tallow, bark, and silk. The importation of these for every tenth year, until the termination of the official returns, will give a general idea of the quantities imported, and their increase or diminution.

Raw Material of Manufacture imported from all parts in 1773, and every Tenth Year after.

Years.	Iron.	Flax Seed.	Ashes.	Cotton Wool.	Timber.	Tallow.	Bark, Oak.	Silk.	Wood, Deals.	Hemp.	Staves.	Flax.
	Cwts.	Hhds.	Cwts.	Cwts.	Tons.	Cwts.	lbs.	lbs.	No.	Cwts.	No.	Cwts.
1773	126,376	39,750	62,729	3,729	11,530	...	75,290	...	7,528	9,670	34,821	10,551
1783	164,187	24,617	130,893	4,550	8,569	...	90,836	...	10,167	7,222	19,032	3,680
1793	228,830	59,079	93,756	20,503	29,651	1,561	165,200	...	101,665	31,604	43,448	13,560
1803	245,208	25,269	102,588	18,378	19,379	28,999	110,321	...	23,235	28,712	24,495	11,687
1813	414,351	38,108	128,111	26,109	120,603	5,106	139,419	104,227	16,479	21,792	53,121	1,145
1823	277,755	49,801	119,499	34,162	49,735	52,905	115,441	49,167	4,585	21,145	37,017	4,530

The exports from Ireland are chiefly the agricultural produce of the country, with a few manufactured articles produced from them, without having undergone many processes of manipulation. The articles forming these exports, and the increase or decrease of value of each description sent into Great Britain after a lapse of ten years, terminating at the latest period of which official documents afford information, may be deduced from the following table:—

Species of Exports to Great Britain, and the value of each description, at two periods of Ten Years distance.

	1815.	1821.
Bacon and hams	L.378,161	L.519,049
Beef	148,452	126,714
Butter	463,130	621,245
Grain, meal, &c	683,557	1,700,963
Cotton goods		356,819
Cows and oxen	37,252	146,935
Flax, dressed and undressed	47,448	101,424
Hides	10,241	7,731
Horses	16,845	39,832
Lard	21,595	44,998
Linens	1,628,659	2,111,696
Paper		32,546
Pork	227,561	167,879
Sheep		16,236
Skins	25,162	9,090
Spirits, Irish	40,325	55,787
Swine		32,959
Wool	33,774	29,427
Yarn, cotton		20,980
—— linen	75,247	26,234
Other articles	264,786	376,018
	L.4,167,597	6,544,575

Taking the article of linen from among those quoted in this table, to show the increasing ratio of the cross-channel trade, and its superiority over that with all the rest of the world besides, the following totals of the number of millions of yards exported to Great Britain and elsewhere will serve as a satisfactory illustration of the fact.

1801.	1805.	1809.	1815.	1817.	1821.	1825.
37	43	37	39	56	49	55
34	40	33	35	50	45	52½
3	3	4	4	6	4	2½

The facilities for promoting this mutual intercourse, to which both countries owe so much, have been augmented to an extraordinary degree by the discovery of open-sea steam navigation. The earliest attempt at establishing a company for this purpose was made in Dublin about the year 1816. Two small vessels were fitted out; but the construction of their machinery was faulty, their dimensions were too small, and the effort proved abortive. Now, the trade, with the exception of that of coal, is chiefly carried on by means of steam.

Many of the principal features of the character of the people may be deduced from the preceding summary of their history, and of their present state. In appearance, the peasantry are of full size, strong, vigorous, athletic, healthy; capable of much labour, but averse from long continued exertion. In moral and intellectual qualities they are ardent in their affections, extreme in the indulgence of their passions both of love and hatred, easily roused, desperate and daring to excess when excited, but also quickly dispirited and deeply desponding under failure; vivacious, social, much attached to home, dreading expatriation more than death; addicted to rural sports and amusements; fond of music and song, and still more so of dancing; adhering with inviolable fidelity to their engagements to each other, but lax in their sentiments of moral obligation towards those whom they consider as their enemies; of quick, shrewd intellect, admirers of literature, and vain of their own acquirements in it. This general description, both of external and intellectual qualities, is varied by striking shades of difference in the different parts of the country. Derived from distinct aboriginal stocks, the inhabitants of each province, particularly those in the extreme and less-frequented districts of each, exhibit marked traits of their parentage, in person, physiognomy, customs, and language. In the north-eastern part of Ulster, the Scotch features, dialect, manners, and dispositions, are strikingly prevalent. In the south of Leinster the peasants still retain much of the old English language and customs. In Kerry, the Spanish descent is clearly to be traced in the personal appearance, the dress, and the style of building prevalent there. In Connaught and the north-west, the vestiges of the aboriginal Celt is still prominently conspicuous. The Irish language is spoken in all parts except in the Welsh colony in Wexford, and in that of the Scotch settlers in the east of Ulster, but with marked variations of dialect and tone in various parts. That of the mountainous districts of Donegal is said, by those deemed to be adepts in the study of national philology, to be the most pure. Few countries exhibit such a contrast in the architectural construction of the habitations of the higher and lower orders. The mansions of the nobility and great landed gentry are capacious, splendid, and fitted up with every appendage of rural luxury. Those of the middling classes, whose great ambition it is to imitate, and if possible to rival, the style of living of their superiors, are generally neat and elegant. The glebe-houses of the Protestant clergy exhibit every appearance of English comfort. The cottages of the peasantry are seldom more than huts of earth, covered with straw, with one or two windows. In the mountainous districts, where timber is scarce, they are miserable in the extreme. The clothing of the great body of the people is home-made frize and linen. The former material is generally dyed with some peculiar tint that marks at sight the locality of the wearer. Latterly, cottons have superseded to a great extent the use of linen, particularly amongst the women. The universal food is the potato, aided occasionally by bacon, and, in the maritime parts, by fish. Milk is the usual beverage. Indulgence in spirituous liquors has long been imputed to the Irish as a national vice. There is a very trite proverb throughout the country, that where there is smoke, there is fire. Even though true, it admits of the qualification, that where there is most smoke, there is often but little fire. A reference to facts and printed documents will show that the quantity of spirits consumed in Ireland, compared with that in the other divisions of the united kingdom, does not bear out the sweeping and prevalent charge of excessive inebriety. Parliamentary documents lately published furnish the following statement of the number of gallons of spirits of every kind that paid duty in each part of the united kingdom.

	England.	Scotland.	Ireland.	Total.
	Gal.	Gal.	Gal.	Gal.
Rum	3,306,650	111,169	27,358	3,345,177
Brandy	1,326,204	37,075	25,360	1,388,639
Geneva	13,075	6,075	2,264	21,632
Other foreign spirits	8,003	1,534	364	9,901
Total foreign	4,554,086	155,917	55,346	4,765,349
Home-made spirits	7,654,465	6,045,043	9,708,462	23,407,970
General total	12,208,551	6,200,960	9,763,808	28,173,319

According to the data here afforded, the average consumption of spirits, compared with the population of each portion of the united kingdom, will be as follows:

	England.	Scotland.	Ireland.	Total.
Population in millions	13	$2\frac{1}{4}$	$7\frac{3}{4}$	22
Spirits in millions of gallons	$12\frac{1}{4}$	$6\frac{1}{4}$	$9\frac{1}{4}$	28
Average consumption per man in gallons, nearly	1	$2\frac{3}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$

So that England being the standard of unity, the excess of consumption is but one fourth in Ireland, whilst it rises to one and three fourths in Scotland. A deduction, however, must be made for the large quantity of spirits sent, by some strange anomaly in the management of the excise, from Scotland, both into England and Ireland, notwithstanding the lower rate of duty here; for which, if due allowance be made, it is probable that the average consumption of ardent spirits will be found to be nearly equal throughout all parts of the united kingdom, and that the character of excess which still adheres to Ireland may be accounted for partly from prejudice, which is apt to cling pertinaciously to long-established and old opinions, and partly to the fact that the indulgence on the part of the lower classes is more public.

As far as drunkenness and crime are connected in the relation of cause and effect, the comparative view of convictions in Ireland shows that crimes of atrocity, which are most likely to be the result of passions excited by the excessive indulgence in spirituous liquors, are on the decline. The number of executions is considerably diminished since 1822, and of those which have taken place, many, if not most, were for murders connected with political circumstances. The following table exhibits a view of the criminal offences from 1822 to 1834 inclusive.

	1822.	1823.	1824.	1825.	1826.	1827.	1828.	1829.	1830.	1831.	1832.	1833.	1834.
Committed—Males	12,766	12,240	12,444	12,563	13,268	14,508	11,909	12,471	12,709	13,148	13,160	14,923	17,757
Females	2,485	2,392	2,814	2,952	3,050	3,433	2,764	2,800	3,085	3,044	2,896	2,896	3,624
Total	15,251	14,632	15,258	15,515	16,318	18,031	14,683	15,271	15,794	16,192	16,056	17,819	21,381
Not prosecuted	157	181	184	163	187	304	91	...	...	...	..	...	...
No bills found	4,659	4,473	4,431	4,392	4,645	4,461	3,078	3,200	3,463	3,694	3,848	3,970	4,593
Acquitted	2,863	2,693	2,901	2,389	2,770	3,059	2,245	2,622	2,429	2,893	2,449	2,405	2,535
Convicted and sentenced to death	341	241	295	181	281	346	211	224	262	307	319	237	197
Transportation for life	57	27	26	45	49	118	66	51	93	178	162	224	244
Transportation for 14 years	29	17	21	17	31	44	20	15	25	26	29	21	11
Transportation for 7 years	633	607	692	733	762	985	665	746	839	872	956	711	781
Imprisonment for 3 years	10	2	2	6	1	1	3	2	...	1	...	10	2
Imprisonment for 2 years	118	115	76	108	98	69	75	90	55	120	102	199	151
Imprisonment for 1 year	555	621	745	785	883	947	880	919	563	844	914	924	1,053
Imprisonment for 6 months and under	5,571	5,370	5,495	6,395	6,283	6,846	6,449	6,526	7,506	6,840	6,905	8,836	11,190
Fined	258	285	390	331	328	851	900	876	559	417	372	282	624
Total convicted	7,572	7,285	7,743	8,571	8,716	10,207	9,269	9,449	9,902	9,605	9,759	11,444	14,253
Executed	101	61	60	18	34	37	21	38	39	37	39	39	42

Statistics.

Other official documents for last year tend to show, as far as the number of places for vending spirits can exhibit it, that their sale is more general in England than in either Scotland or Ireland, whilst in the last-named portion of the kingdom the consumption of beer is evidently on the increase. Of the following summaries the former gives the number of retail spirit-licenses issued last year, the latter the quantity of malt used by brewers.

	England.	Scotland.	Ireland.	Total.
1.	47,312	16,278	18,416	82,006
2.	15,837,409	997,771	2,055,326	10,890,506

The following table of the consumption of articles of foreign luxury may serve as a criterion of the progress of refinement throughout the country. In drawing conclusions from it, the increase of the population at each period here stated should be kept in mind.

Quantities of Articles Imported for Home Consumption in 1784, and for every Fourth Year after.

Year.	Sugar.	Tea.	Coffee.	Wine.	Brandy and Geneva.	Rum.	Tobacco.
	Cwts.	Lbs.	Lbs.	Gallons.	Wine Gallons.	Wine Gallons.	Lbs.
1784	190,483	1,551,228	7,182	1,069,232	461,802	883,858	3,477,649
1788	196,633	1,545,900	38,458	1,219,370	373,420	992,103	3,120,048
1792	161,302	1,844,598	40,313	1,339,800	132,851	501,984	1,767,581
1796	182,668	2,326,306	61,571	1,199,129	13,716	111,475	6,045,790
1800	355,662	2,926,166	120,985	1,024,832	204,494	1,036,467	6,737,275
1804	313,710	3,337,122	243,494	1,708,510	22,137	203,837	5,783,487
1808	437,867	3,706,771	136,713	1,189,716	27,089	410,791	5,847,416
1812	450,713	3,758,499	505,497	892,946	9,936	339,762	5,896,702
1816	302,387	2,990,580	253,712	439,602	7,896	22,843	4,732,085
1820	320,733	3,150,344	207,123	508,501	11,290	24,468	2,582,498
1824	410,163	3,387,510	269,883	564,529	1,675	11,343	3,749,732

The statement of savings' banks already given may also serve as another element of calculation in forming the same estimate. Friendly societies, so largely spread over England, and protected there by several statutory enactments, seem to have taken but little root in Ireland. The following return shows the number of these societies, whose regulations are filed with the clerks of the peace, according to the law, from 1792 to 1832, a period of forty years, viz. England, 17,365; Scotland, 2144; Ireland, 274.

Education.

The efforts to improve the state of the people by religious and literary instruction have been numerous and extended. For some centuries after the settlement of the English, these efforts were, however, conducted on a principle as unjust as impolitic. All attempts at bettering the condition of the people were limited to the English settlers or the inhabitants of the pale, those of the rest of the island being treated as enemies. To such a height was the distinction carried, that whilst the murder of an Englishman was death, that of a native was suffered to go unpunished, provided it could be proved that he was mere Irish, and not one of the five bloods of the O'Neills, O'Melaghlins, O'Connors, O'Briens, and M'Murroughs, who were admitted by special favour to the privileges of English subjects. It was not till the reign of James I. that the whole of the island was allowed to participate in the protection afforded by English law.

The machinery used for diffusing religious instruction has already been developed in the account of the ecclesiastical state of the country. That of the literary instruction remains to be stated. It may be arranged under three heads; collegiate institutions for the higher departments of science and literature; academies and schools for rudimental instruction in the same studies; and primary schools for affording the first elements of knowledge to the great mass of the population.

The first attempt at founding an university after the arrival of the English was made by John Leek, archbishop of Dublin, who obtained a papal bull for the purpose in 1311, which was carried into effect in 1320 by Alexander Bicknor, his successor. The disturbed state of the country prevented its success. Little more is known of it than that, after lingering through an existence of some time, it died away. Another similar attempt was made, with similar success, at Drogheda, where an university was founded by act of parliament in 1465, with the same privileges as that of Oxford. The next attempt was more happy. In 1593 the university of Trinity College, Dublin, was opened in the buildings of the dissolved monastery of All-Hallows. It still continues to be the sole university in Ireland. Another was opened by James II.; but after his flight it was handed over to Trinity College, and soon afterwards finally closed. The celebrated Henry Flood left a bequest for the endowment of a college after his death; but the legacy lapsed, from a neglect of applying it within the proper time. In 1810 the inhabitants of Belfast opened a collegiate institution for scientific and literary instruction by private subscription. It has been sanctioned by act of parliament, and receives a liberal grant of public money; but as it has not been privileged to grant degrees, it cannot be ranked as a university.

With respect to the second class of places of public education, an act of Elizabeth required that a grammar-school should be maintained in every diocese, by the contributions of the bishop and beneficed clergy. James I. improved on the idea, by vesting large tracts of forfeited lands for the maintenance of similar schools. His example was followed by Charles I. Erasmus Smith, also, one of the adventurers who obtained large tracts of land during the time of Cromwell, applied some of his property to this purpose. Classical schools were also endowed by other private individuals. The schools of royal foundation were those of Armagh, Dungannon, Enniskillen, Raphoe, Cavan, Banagher, and Carysfort. Those of Erasmus Smith's, and other private foundations, were, Drogheda, Galway, Tipperary, Ennis, Navan, and Ballyroan. The diocesan schools never exceeded seventeen out of the twenty-two dioceses.

The primary schools owe their foundation to an act of Henry VIII., which bound every incumbent of a parish by oath to maintain a school therein to teach the English language. The bond was neglected by many, and observed with culpable laxity by most others. The statute having fixed upon forty shillings as the minimum of the teacher's salary at the time of its enactment, the incumbent, regardless of the great subsequent depression of the value of money, deemed his duty to be fulfilled and his conscience cleared by paying that annual stipend to his parish-clerk, or some other person who professed to teach in the parish. Soon

Statistics. after the revolution, a project was started and eagerly followed up by the established clergy, of founding schools, in which the children of the poor should be instructed in the rudiments of literature, as well as in useful works, and also maintained at the public expense. To these laudable objects was also added that of converting them to the Protestant doctrine. These schools being incorporated by act of parliament, received the name of charter-schools. They were long a favourite object of interest to the legislature, which annually voted large sums for their support, in addition to those procured by donation or bequest. Notwithstanding several essays on general education were subsequently written, and the subject brought before parliament at different times, nothing further was practically attempted till 1819, when a voluntary society was formed in Dublin, for the avowed purpose of instructing the poor, without interfering with their religious opinions. The society was at first generally supported; and being aided by liberal grants of public money, promised fair to achieve its professed object. But a stipulation introduced into its regulations shortly after its commencement, requiring the Bible to be used as a school-book, aroused the suspicions of the Roman Catholic clergy, who excited such a distaste to it throughout the country, that it was found expedient to withdraw the grant, and to transfer the management to another body. The important duty of providing literary instruction to the great body of the people is now delegated to a board, consisting of the two archbishops of Dublin, the moderator of the synod of Ulster, and a few other commissioners nominated by the crown. The main feature of difference between this board and the society it superseded, generally called the Kildare Place Society, from the site of its offices and model school, is, that instead of insisting on the Bible being used as a school-book in all cases, selections from it are employed for the purpose of general education, and a portion of every week set apart, in which the clergy of each religious persuasion may instruct the pupils of their own flock in the peculiar tenets of their doctrines. The board has been too short a time in existence to form a decisive opinion as to its probable results. Its views are sufficiently extensive. It proposes to establish five professorships in the training institution: 1. Of the art of teaching and conducting schools; 2. of composition, English literature, history, geography, and political economy; 3. of natural history in all its branches; 4. of mathematics and mathematical science; 5. of mental philosophy, including the elements of logic and rhetoric. Every candidate for the charge of a school is to study at least two years in this department, so as to receive instruction in all the departments of knowledge there taught. It is also proposed to establish a model-school for each county, in which all candidates for admission into the central training establishment should undergo a preparatory process of instruction. The annual salaries of teachers of primary schools is estimated at L.25, with a gratuity of L.5 dependent on good conduct; and that of a teacher in the model schools at L.100, with two assistants at L.50 each.

The population of Ireland being estimated at 8,000,000, of which about one seventh, or 1,140,000, are between the ages of seven and thirteen, and as one half of that number would require the aid of the national system of education, there should be 5000 schools, of an average of 100 pupils each, established. Supposing this number to be completed in nine years, during which the expenses would fluctuate according to the number of schools erected each year, it is estimated that the system could be carried on permanently at an annual expenditure of about L.200,000. The amount is very great, yet probably not more than the magnitude and importance of the undertaking requires. The following table contains a statement of it, formed from the latest official document presented to parliament, and containing also an account of the sums already expended in carrying the plan into effect, during the three years since the issuing of the commission.

Expenditure of the Commissioners of National Education during the time of the existence of the Commission, and an Estimate of the Expenditure required to render it effective in future.

		Official Establishment, and Incidents.	Teachers of Model Schools.	Teachers of Primary Schools.	Books and School Requisites.	Inspection.	Training.	Building Model Schools.	Building Primary Schools.	Teachers of Present Establishment.	Total.
		L.	L.	L.	L.	L.	L.	L.	L.	L.	L.
Actual expenditure.	1833	2,308	580	...	1,844	862	...	...	2,827	2,224	10,645
	1834	3,650	2,049	...	4,341	1,960	66	...	6,113	5,274	23,453
	1835	5,694	1,078	...	4,662	2,438	778	...	9,007	9,221	32,878
Proposed Expenditure.	1836	4,000	...	...	6,000	2,400	6,000	15,000	2,000	11,824	47,224
	1837	4,000	4,000	...	7,000	3,000	6,000	9,000	90,500	11,824	115,324
	1838	4,500	6,400	15,000	7,500	3,000	7,000	...	180,500	7,000	230,900
	1839	5,000	6,400	45,000	10,000	3,000	8,000	...	180,000	2,000	259,400
	1840	6,000	6,400	75,000	12,000	3,500	8,500	...	180,000	1,000	292,400
	1841	7,000	6,400	105,000	14,000	3,500	9,000	...	180,000	...	324,900
	1842	8,000	6,400	135,000	17,000	4,000	9,000	...	45,000	...	224,400
	1843	9,000	6,400	142,500	18,000	4,000	10,000	...	27,000	...	216,900
	1844	10,000	6,400	147,000	20,000	4,000	10,000	...	18,000	...	215,400
	1845	10,000	6,400	150,000	20,000	4,000	10,000	...	...	...	200,400
		79,152	58,907	814,500	142,347	39,660	84,344	24,000	920,947	50,367	2,214,224

Since the commencement of the present century, four parliamentary inquiries have been instituted relative to this great national subject. The first, which commenced in 1810, published fourteen reports, containing a copious, accurate, and well-digested view of the then state of public education in Ireland, which presented a very discouraging detail of negligence and abuse among those to whom the care of the funds granted for education had been intrusted. The summary of it furnishes the following statement of the number of endowed schools and pupils, and the expense of their education:

Schools.	Annual Income.	No. of Pupils.	Average Cost of each.
Classical	L.9,000	1000	L.9
English	70,000	4200	19

in which latter average the maintenance of the pupils is

Statistics. included in many cases. The total number of pupils in seventeen dioceses out of twenty-two, from which only returns could be obtained, was 3736 schools, containing 162,467 pupils, of whom 45,490 were Protestants and 116,977 Catholics; whence the commissioners inferred that the total numbers of schools and pupils in Ireland were 4600 and 200,000. The second parliamentary inquiry was made during the progress of taking the census in 1821, in which the enumerators were required to report the number of pupils in each school. The result not being a primary object of inquiry, cannot be considered as strictly accurate. In 1824 another parliamentary commission was issued, which published a very minute statement of all the important particulars relative to the numbers, religious persuasions, and localities of the teachers and pupils, and paved the way for the formation of the board of national education, already noticed. The reports of this board form the fourth official statement on the subject. The three last-named sources supply the following summary of the state of education at the periods stated in them, throughout the four provinces of Ireland:

Number of Pupils receiving Public Instruction in the Years specified.

	1821.			1826.				1834.		
	Males.	Females.	Total.	Males.	Females.	Not ascertained.	Total.	Males.	Females.	Total.
Leinster...	75,510	38,788	114,298	94,405	64,502	2,124	161,031	27,737	22,219	49,956
Munster...	89,225	40,070	129,295	123,766	65,342	1,985	191,093	18,726	13,775	32,501
Ulster......	69,490	35,244	104,734	83,653	54,556	3,750	141,959	27,507	18,104	45,611
Connaught	31,381	15,105	46,486	48,088	25,527	1,266	74,881	10,675	6,778	17,453
Ireland.....	265,606	129,207	394,813	349,912	209,927	9,125	568,964	84,645	60,876	145,521

Antiquities. In a general view of the country, the antiquities cannot be wholly passed unnoticed, although, to do justice to the subject, a much larger scope would be required than the limits here prescribed will permit. They may be classed in two great divisions, Pagan and Christian. Of the former, the round or pillar towers are the most striking and unique. They are tall, narrow, circular buildings, generally from forty to fifty feet in exterior circumference at their base, rising to a height of upwards of a hundred feet, topped, when perfect, with a conical roof, having the entrance several feet above the level of the surrounding country, some of them with projections for four or five tiers of floors, and with four small windows near the summit, generally opposite to the cardinal points. The sites of upwards of ninety of them have been discovered. Their origin and purpose are wrapt in equal uncertainty. That they were anterior to any other erections of stone in the country is now generally admitted; and the opinion that they were somehow connected with the ceremonies of fire-worship is gaining ground. Altars, commonly called Brehon's chairs, circular enclosures of huge pillar stones, rocking stones, cromleachs, and cairns, are to be found in several places; Danish raths or moats everywhere. Among the more anomalous antiquities of this class, a building, called by Vallancey a ship temple, near Dundalk, a subterraneous, cruciform cavern at New Grange, and a singular circular building in Kerry, formed of stone without mortar, of the appearance of an amphitheatre, are the most singular. Weapons and implements of mixed metal, and ornaments of pure gold, found in bogs, may be referred to the same period.

The Christian antiquities may be classed into ecclesiastical, military, and civil. The first comprehend the monasteries, churches, chapels, and cells, of which some are large and of an imposing appearance, though none worthy of comparison in these respects with similar buildings in England or on the Continent, while others are of very limited dimensions and inartificial structure. Of the castles, some retain traces of great feudal grandeur; but the greater number are merely square forts, erected for the reception of a small detachment adequate to guard a pass, or keep a surrounding sept under control. The buildings of a character purely civil are confined to corporate towns.

Conclusion. A retrospect of the preceding concise summaries of Irish history and statistics may serve to show, that though much has been done towards the full development of the capabilities of the country, so as to enable it to contribute its full share to the maintenance, and derive its adequate portion of advantage from the prosperity, of the empire of which it forms so important a part, much still remains to be effected. During the period that has elapsed since the revolution in 1688, a revolution still more pregnant in consequences to Ireland than either to England or Scotland, a variety of tranquillizing remedies have been applied to heal the evils of centuries of turbulence and discord, each of which was in turn deemed a panacea of power to eradicate every grievance. Shortly after that period, education, on principles exclusively Protestant, was expected to secure not only the allegiance, but the conversion, of the great body of the people. Agricultural improvement was then recommended. A closer connection with the other portion of the empire was afterwards suggested. Reform was called for, and now a very prevalent longing indicates itself among the great body of the people for the restitution of its domestic legislature. Education has been tried repeatedly, and in various forms, on a scale of liberal, if not lavish expenditure. Agriculture has extended itself into every part. Religious distinctions have been done away with. Reform has been procured. Yet still a country, endowed beyond most others, through its natural resources, with capabilities for the attainment of wealth, prosperity, and happiness, continues in a state of comparative destitution as regards the means of subsistence, and of degradation as respects the intellectual character of the great mass of its population. A contemplation of this fact has led some to the conclusion that there is something anomalous in the Irish character which prevents the means of melioration, effective elsewhere, from acting beneficially upon it. Such a conclusion would be as disheartening to the philanthropist, who aims at the improvement of the people, as degrading to the nation that merited the imputation. Before it be irrevocably formed, one experiment more should be added to those already tried, founded on the principle that Irishmen are moulded of the same material as the rest of mankind,—the application of a steady, well-devised system of cheap government, and even-handed justice.

IRELAND, New, an island in the eastern seas, north from New Britain. It is long and narrow, and extends from north-west to south-east about 190 miles. Its aspect from the sea is very mountainous, and appears to be covered with thick woods, which abound in pigeons, parrots, and other birds. The inhabitants are in a state of barbarity, black and woolly headed like negroes; but without the flat nose and thick lips. Their canoes are very long and narrow; one of them, that was formed of a single tree, was not less than ninety feet in length. It is situated between Long. 150° 30′ and 153° 5′ E. and Lat. 33° 40′ and 50° S.

IRENÆUS, St, a bishop of Lyons, was born in Greece about the year 120 of our era. He was the disciple of Pappias and Polycarp, by whom, it is said, he was sent into Gaul in 157. He lived at Lyons, where he performed the office of a priest; and in 178 was sent to Rome, where he disputed with Valentinus, and his two disciples Florinus and Blastus. At his return to Lyons, he succeeded Photinus, bishop of that city; and suffered martyrdom in 202, under the reign of Severus. He wrote many books in Greek, but there only remains a barbarous Latin version of his five books against heretics, some Greek fragments in different authors, and Pope Victor's letter mentioned by Eusebius. The best editions of his works are those of Erasmus, in 1526; of Grabe, in 1702; and of Father Massuet, in 1710.

He ought not to be confounded with St Irenæus the deacon, who, in 275, suffered martyrdom in Tuscany, under the reign of Aurelian; nor with St Irenæus, bishop of Sirmich, who suffered martyrdom on the 25th of March 304, during the persecution of Diocletian and Maximianus.

IRENE, empress of the east, celebrated for her valour, wit, and beauty; but detestable for her cruelty, having sacrificed her own son to the ambition of reigning alone. She died in 803.

IRIS, in *Physiology*, the rainbow. The word is Greek, ἶρις, supposed by some to be derived from εἰρω, I speak, I tell; as being a meteor that is supposed to foretell, or rather to declare rain.

Iris is also applied to those changeable colours which sometimes appear in the glasses of telescopes, microscopes, and such like instruments, and is so called from their similitude to a rainbow. The same appellation is also given to that coloured spectrum, which a triangular prismatic glass will project on a wall, when placed at a due angle in the sunbeams.

IRJAH, an Afghan town in the province of Cabul, fifty-five miles S.E. from the city of Cabul. Lat. 33° 54′ N.; Long. 69° 5′ E.

IRKOUTSK, an extensive government of Russia, comprehending all the eastern part of Siberia or Asiatic Russia. It is bounded on the east by the Pacific Ocean, or, more properly, by its gulfs called the Seas of Kamtschatka, Okhotsk, and Anadyr; on the north by the Frozen Ocean; on the west by Tobolsk; and on the south by vast chains of mountains, continued from the Altai chain, by which it is separated from Chinese Tartary. It extends about twenty-eight degrees from east to west, and twenty-five from north to south, and comprises 126,460 square geographical miles. It was erected into a separate government in 1763, being formerly included in the government of Tobolsk; and, in 1783, the Empress Catharine conferred on it the privileges of a state. It was converted into a separate government, owing to the great extent of the country, and the same cause occasioned its subsequent division into four separate districts, namely, Irkoutsk Proper, Nertschink, Yakantsk, and Okhotsk; the first comprehending the southern and fertile districts situated round the Baikal, and near the sources of the Lena and its tributaries. Yakantsk extends as far as the Arctic Ocean, comprehending the vast and frozen plains which extend northward to that sea. Okhotsk extends along the eastern shore of Asia, and includes not only Kamtschatka, but the Aleutian and Kurile isles, thus bordering on one side with America, on the other with Japan. It is traversed by the Lena and its tributaries, throughout its whole extent from north to south. There are also the Olonek, the Indigirka, and the Kovyma, which are large rivers, and fall into the icy sea. An imperfect census has been made of the population, according to which they were reckoned at between 400,000 and 500,000, and they have been considerably increased. Russians and Cossacks form a considerable proportion of the inhabitants. These are composed of colonists, merchants, and of those who are employed in the civil and military establishments of the state, Great part of the province is occupied by the native tribes. who lead a wandering and pastoral life, or gain a living by hunting and fishing. The most numerous of these are the Tunguses. There are also the Mongols, who occupy the southern parts; the Juraki, a Samoiede tribe, who inhabit the northern districts in the Icy Sea; the Yakantes and Koriaks, who dwell on the eastern coast, and derive a very precarious living from pasture and the chase; the Tschutchi, who occupy the north-east point of Asia; and the rude inhabitants of the Aleutian and Kurile islands.

IRKOUTSK, the capital of the above government and district, containing 1500 wooden houses, with two houses of stone. The streets are unpaved, though, owing to the fineness of the weather, they are seldom dirty. It contains thirty-three churches and two cloisters, and is also the seat of an archbishop, and the station of the officers of the government and a considerable body of troops. A seminary is maintained here by government, a popular school, and, since 1762, a school has been established for the Japanese language and navigation. An hospital was also established in 1772 for the small-pox. Irkoutsk is also a commercial mart of considerable importance, and is the residence of many merchants engaged in the trade between Russia and China, which is carried on at Kiachta. It has in a good degree the aspect of a Chinese town, from the quantities of porcelain, enamelled and lacquered ware, and Chinese articles of dress and furniture, with which the houses are filled. Long. 103° 30′ E.; Lat. 52° 16′ N.

IRON, one of the metals, and one of the hardest and most useful, as well as the most abundant.

IRON-MAKING.

I.—HISTORY.

History.

It is probable that iron was first accidentally obtained during the operation of carbonizing wood. If the surface of the country where this process was performed abounded in ores of iron, fragments might casually find admission to the fire, and, sinking through the ignited charcoal, become partially reduced. An analogous case is presented to us in the roasting of ironstone as now practised; some peculiar species of which, associated with a large quantity of bituminous matter, have, under favourable circumstances, produced, during that process, plates of imperfectly malleable iron.

Once discovered, whether by accident or otherwise, it is scarcely conceivable, that a metal possessed of so many valuable and obvious properties, would be long suffered to remain an unique specimen. The benefit likely to accrue, by being able to procure it at will, would lead at once to numerous experiments, probably at first attended with little success. The simple, turf-covered fire of charcoal, in which the discovery was made, being found inadequate to the regular attainment of the desired end, would give place to the rude structure of stone, and this, subject to various and gradual improvements during a long period of years, would at length be superseded by the powerful blast-furnace such as we find it at the present day.

To trace the causes and principles of these improvements, the manner in which they modified the original process, and to shew their influence on the extent and progress of the iron trade from its commencement, cannot be uninteresting. The first smelting-furnace peculiar to the manufacture, was undoubtedly the air-bloomery, a low conical structure, with small openings at the bottom for the admission of air, and a larger orifice at top, for carrying off the gaseous products of combustion. In order to produce iron, the interior was filled with alternate strata of charcoal and ore; fire was applied at the lowest part, and the heat was regulated by the narrowing or enlarging of the small apertures. Such a structure it probably was that the Romans made use of to smelt the ores of this island; scoria, the refuse of ancient bloomeries, occurs in various localities, in some cases more particularly identified with that people, by the coincident remains of altars inscribed to the god who presided over iron. Park represents the rude furnace just described as employed by the Africans; indeed, with some slight modifications, it is still retained even in Spain, and along the coasts of the Mediterranean, where rich specular ores are worked.

At what time the simple air-bloomery ceased to be the iron-making furnace of this country, it is impossible to say, the event being so remote. It is certain, however, that the next era which marked the progress of the manufacture was occasioned by the introduction of bellows, a very obvious substitute for the natural current of air hitherto employed. This instrument, which had probably arrived at some degree of perfection before its application to the new purpose, presented at once considerable advantages. It obviated the necessity of an elevated site for the bloomery, and it put the blast more immediately under the dominion of the smelter, which before had been irregular or intermittent during the progress of the same process, and at all times more or less dependent on the weather. By the application of bellows, some slight alterations in the furnace were rendered necessary. The new construction was built of stone, capable of enduring a high temperature, about two feet in height, and from one and a half to two feet square within. Besides the orifice or chimney at top, there were two openings, one large in front, for drawing out the metal, the other of smaller dimensions behind, for the insertion of the bellows pipe. Such was the *blast-bloomery*.

History.

Let us now contrast the operation, with its products in each case, as performed in the two furnaces which have been described, and which differ apparently so little. In the *air-bloomery*, the principle of reduction consisted in the deoxidation of a very rich ore, which, broken into moderately-sized pieces, was subjected to a long-continued cementation. The ore was, of course, never brought into a fluid state, although the fragments became soft, and tended to coalesce. A small quantity of the associated earthy matter was separated in the furnace. Accordingly, when taken out, the iron was imperfectly malleable, being mixed, to a greater or less extent, with scoria and unreduced oxide. This put at once under the hammer of the smith, was fashioned into a rude bloom, and, with other hammerings, the greater portion of extraneous ingredients was removed. In the *blast-bloomery*, on the other hand, although the furnace was probably charged in the same manner, and although the fire was still urged by common air, yet, on account of the greater strength and regularity of blast, and consequently greater heat produced, the result was very different. The ore, after being deoxygenated, imbibed a portion of carbon, and sunk in a fluid state to the bottom of the furnace. Thus the resulting metal was not, as with the *air-bloomery*, malleable; it was rather a species of steel, utterly useless to the workmen of these days, unless we imagine that a sort of refining process had been invented. Here, then, it seems necessary to infer, that the fluid metal was covered afresh with charcoal, the slag or vitrid matter having been previously run off; and that the nozzle of the bellows-pipe being inclined, a continued stream of air was made to play upon the surface. In this manner the carbon was burned out, the metal worked thick and tough, and fresh surfaces being continually exposed, became eventually capable of extension under the hammer.

To form an accurate idea of what the iron trade must have been during the period that the blast-bloomery was the exclusive instrument of manufacture, is not permitted to us, by the existence of any authentic document. Some conjecture, however, favourable to the opinion of its extreme insignificance, may be advanced, when we call to recollection the diminutive size of the furnace, the small quantity of iron extracted from the ore (about one-half of what it contained), and the inconsiderable extent to which, at so early a stage of society, the division of labour had been carried. This, however, was a state of things which every day improved. To the progress of internal communication, then in its infancy, the appreciation and pursuit of new sources of wealth, the establishment of manufactures, and to various other causes, as continually favouring the rapid consumption of iron, are to be attributed those improvements in the bloomery, which finally led to the construction of the blast-furnace, with all the innovations on old-established practice, which its gradual introduction as naturally produced.

It is reasonable to suppose, that an increasing demand led the iron-smelter to speculate on the facilities which would be given to his trade, by enlarging the capacity of the bloomery. This, however, he probably did not foresee; namely, that every such enlargement, by prolonging the descent of the ore through the furnace, exposed it to a lengthened contact with the charcoal, and consequently to a proportionally great absorption of carbon, and that thus eventually the different varieties of cast-iron, a compound till then perhaps unknown, would be produced.

From the time that cast-iron became the product of the smelting-furnace may be dated the refining of iron, considered as a separate operation, and requiring as such a separate furnace and machinery. Enlargements in the blast-bloomery, unaccompanied by any alteration in form, could not be so made beyond a certain limit. After the furnace had reached a certain height, the column of materials in the interior would be found to weigh so heavily downwards, as to repress the ascent, and render soft the quantity of blast, which had been sufficient to penetrate a column of three or four feet in the old bloomery. It was then that a suspending agent was first thought of, and those internal buttresses were introduced, which either then or subsequently received the name of boshes. These, by creating immediately above the tuyeres a lateral suspension of the materials, relieved the pressure on the central parts of the furnace, and allowed the blast to ascend with comparative freedom. Whilst the good quality of the iron and the regularity of the process were thus insured, increase in quantity was the result of improvements in the blowing apparatus, which, hitherto worked solely by animal power, was now made to depend on the greater efficiency afforded by the employment of water. With these modifications, the furnace, as regards construction, was essentially the same as that at present used, though not so large; indeed, until the introduction of coke at a much later period, the blast-furnace seldom exceeded fifteen feet in height, by six at the widest diameter. During the long period that the air and blast-bloomeries had been the only iron-making furnaces, large accumulations of scoria, containing from 30 to 40 per cent. of iron, had formed. The more perfect operation of the blast-furnace allowed these to be re-smelted with great advantage; a new species of property was thus created; extensive proprietorships of Danish and Roman cinders were formed; large deposits of scoria, which for ages had lain concealed beneath forests of decayed oak, were dug up; and in Dean Forest, it is computed that twenty furnaces, for a period of upwards of three hundred years, were supplied chiefly with the bloomery cinders, as a substitute for iron-ore.

At what period the complete transformation of the blast-bloomery into the blast-furnace was effected, it is impossible to say. It was probably during the early part of the sixteenth century, as we find that in the seventeenth the art of casting in metal had arrived at a great degree of perfection; and in the reign of Elizabeth there was a considerable export trade of cast-iron ordnance to the Continent.

In the forest of Dean are the remains of two blast-furnaces, which formerly belonged to the kings of England. But since the commencement of the struggle between Charles the First and his Parliament, these furnaces have not been in blast. Calculating from the quantity of scoria accumulated in the neighbourhood, and which appears to have lain undisturbed for the last two centuries, Mr Mushett[1] has attempted to deduce the period of their erection, which he conceives to have been about the year 1550, in the time of Edward the Sixth.

In reverting to the different facts which have been stated, there is one thing which immediately suggests itself to the imagination, namely, the influence which the gradual adoption of improvements must have exerted in changing the site and locality of the manufacture. The air-bloomery, as has been before noticed, was almost invariably placed on elevated ground. At the introduction of bellows, the furnace became, to a certain extent, independent of the causes which till then had determined its site, and was removed to a lower level, more convenient, as being in the immediate neighbourhood of the ironstone, or of the hamlet where the workmen resided. Finally, the necessity of a more perfect blast than could be obtained by mere animal power, again changed the seat of manufacture, which now sought the deeper valleys, where the drainage of the surrounding country realized a powerful fall of water. In all that has hitherto been said, wood charcoal has been understood as supplying the requisite material for every operation. But the wants of a constantly increasing population, not less than the great consumption of the iron-furnaces themselves, at length gave a check to the manufacture, by depriving it of its vital support, the essential supply of fuel. In many counties, wood had been destroyed to such an extent, that the cutting down of timber for the use of the ironworks was prohibited by special enactments. The forests of Sussex alone appear to have been exempted from this general decree of conservation.

A languishing period of manufacture accompanied the falling off in the supply of charcoal, the number of furnaces decreasing three-fourths; so that, in 1740, the amount of iron produced, which but a short time before is said to have been 180,000 tons a year, was only 17,350 tons. The counties which produced the iron, with the number of furnaces to each, were as follow:

	Furnaces.	Tons.
Brecon,	2	600
Glamorgan,	2	400
Carmarthen,	1	100
Cheshire,	3	1,700
Denbigh,	2	550
Gloucester,	6	2,850
Hereford,	3	1,350
Hampshire,	1	200
Kent,	4	400
Monmouth,	2	900
Nottingham,	1	200
Salop,	6	2,000
Stafford,	2	1,000
Worcester,	2	700
Sussex,	10	1,400
Warwick,	2	700
York,	6	1,400
Derby,	4	800
	59	17,350

	Tons.	Cwt.	Qr.
Annual average quantity for each furnace,	294	1	1
Weekly do. do.	5	13	0

James the First granted patents to ironmasters in different parts of the kingdom for using pit-coal in the manufacture of iron; many obstacles, however, arose in the way of this improvement. The denser substance and incombustibility of coke, and the less active affinity of its carbon as compared with charcoal, for iron and oxygen, required not only a more copious and powerful injection of air, but also that the iron-making materials should remain a longer time together in the interior of the furnace than had hitherto been necessary. An ignorance of the causes of failure herein implied, operated long and seriously; but all difficulties were at length surmounted by enlarging the height of the blast-furnace, so as to prolong the descent and contact of the ore and coke, and more especially by the eventual application of the steam-engine, which rendered the working of the blowing machinery at once regular and powerful.

[1] See *Philosophical Magazine* for 1822.

History.

It was now that furnaces arose, having a capacity of three, four, five, or six thousand cubic feet; whilst of late years, furnaces of ten or twelve thousand cubic feet have been erected, without the maximum effect being decidedly obtained. By the collation of the following table with that which was given as representing the state of the manufacture in 1740, it will be seen that, in 1788, although the absolute quantity of charcoal pig-iron produced was less by 4250 tons, that considerable improvements in the process must have been made, as indicated by the great increase in the amount of produce to each individual furnace.

Counties.	Furnaces.	Tons each.	Total.
Gloucester,	4	650	2,600
Monmouth,	3	700	2,100
Glamorgan,	3	600	1,800
Carmarthen,	1	400	400
Merioneth,	1	400	400
Shropshire,	3	600	1,800
Derby,	1	300	300
York,	1	600	600
Westmoreland,	1	400	400
Cumberland,	1	300	300
Lancashire,	3	700	2,100
Sussex,	2	150	300
	24	Making,	13,100

	Tons.	Cwt.	Qrs.
Annual average produce from each furnace,	545	16	2
Do. of the former period (1740),	294	1	1
Annual increased produce in favour of the improved period,	251	15	1
Average weekly quantity produced in 1788,	10	9	3
Ditto 1740,	5	3	0
Weekly increase in favour of the improved period,	4	16	3

At the same period the number of coke blast-furnaces, with the quantity of iron produced in each county, were as below:

	Furnaces.	Tons each.	Total.
Shropshire,	21	1,100	23,100
Stafford,	6	750	4,500
Cheshire,	1	600	600
Derby,	7	600	4,200
York,	6	750	4,500
Cumberland,	1	700	700
Glamorgan,	6	1,100	6,600
Stafford (about to blow),	3	800	2,400
Brecon,	2	800	1,600
	53		48,200

	Tons.	Cwt.
Annual average produce,	907	0
Weekly do. do.	17	9

Annual manufacture at same period of charcoal iron, 13,100

In the same year there were erected and blowing in Scotland the following furnaces:

	Furnaces.	Tons.	Total.
Goatfield,	1	700	
Bunawe,	1	700	1,400
Coke furnaces.			
Carron,	4	1,000	4,000
Wilsontown,	2	800	1,600

In Britain, total quantity in 1788,	68,300
Ditto in 1740,	17,350
Annual increase of pig-iron,	50,950

About the year 1796 it was contemplated by Mr Pitt, to add to the revenue by a tax upon coal. This, of course, led to a powerful opposition on the part of the manufacturing consumers, particularly in the iron trade. A committee was appointed, witnesses were examined, and the measure was abandoned as unwise and impracticable. The following table exhibits an abstract of the facts collected, and shews the rapid progress of the iron trade in the course of the eight preceding years:

Counties.	No. of Furnaces.	Excise Return of Iron Made.	Supposed Quantity by the Trade.	Actual Return.
Chester.......	2	4,710	2,200	1,958½
Cumberland..	4	5,144	3,000	2,034
Derby.........	3	2,138	2,138	2,107
Gloucester....	2	380	380	380
Hereford......	5	2,850	2,850	2,529
York..........	22	21,984	21,987	17,947
Shropshire ...	23	68,129	43,360	32,969
Wales.........	28	45,994	42,606	35,485
Stafford.......	14	15,820	15,256	13,210½
Sussex........	1	172¾	173	173
	104	167,321¾	133,950	108,793

	Tons.
The return from Scotland exhibited a list of seventeen furnaces, and an exact return of pig-iron manufactured,	16,086
Making a whole annual quantity of	124,879
Annual average produce from each furnace, including the charcoal furnaces,	1,032
Annual average of 1788, including the charcoal furnaces,	800
Increase in tons,	232

As a proof of the rapid strides and progress which the trade was now making, it may be added, that, in the six following years, there were building in England and Wales, forty additional furnaces, and in Scotland seven; the collective manufacture of which was computed at upwards of 170,000 tons annually.

From the preceding statements, some interesting information may be elicited with regard to the extent of the manufacture of iron, at different periods, in various parts of the kingdom, where it is either still successfully prosecuted, or become altogether extinct as a branch of trade.

In the year 1740, the date of the earliest document in our possession with regard to the distribution of blast-furnaces, we find that Gloucester produced a much greater quantity of iron than any other county in Britain. There the manufacture was well understood; indeed, it had been carried on in the forest of Dean from the earliest period. The furnaces were large, as compared with those of other districts; and, in consequence, the amount of iron to each furnace exceeded the general average.

At the period to which we refer, Sussex contained the greatest number of furnaces. With a few in Kent, the residue required to make up the annual complement of iron, at that time about 17,000 tons, were scattered sparingly throughout the midland counties, and along the Welsh borders. Eight-and-forty years afterwards, a little subsequent to the introduction of coke in smelting, the coal counties began to assume that rank in connection with iron, which for ages had been more particularly accorded to the woodland districts; and we find Shropshire making rapid strides towards that importance as an iron-making county, which, in conjunction with Staffordshire, it has ever since maintained. In Shropshire, there was then made a proportion of charcoal iron little less than the produce in that article of Gloucester, Monmouth, or Lancashire, whilst the quantity of coke pig-iron which it turned out, amounted to the enormous sum (comparatively speaking) of 23,100 tons; thus equalling the collective manufacture of all the other coke pig-iron districts in Britain. In the year 1796, the iron manufacture had become well-nigh extinct in Sussex, and altogether so in Kent. On the other hand, South Wales had made great progress towards pre-eminence, though still exceeded by the Shropshire and Staffordshire iron-works. These latter counties, indeed, containing within themselves the seats of the most extensive manufactories of small iron articles, have always required, for their own supply and consumption, an incredible quantity of that material. For a long time, also, the Staffordshire iron-masters enjoyed almost exclusively the advantages conferred by the rolling-mill in the production of various descriptions of iron, such as nail-rods, boiler-plates, hoop and sheet-iron, wire, &c. These advantages they still enjoy to a certain extent, and, in consequence, maintain a greater price for their iron than the Welsh iron-masters. It is in Staffordshire and Shropshire that the manufacture of iron is seen in its greatest perfection. The beauty and finish of their small rolling machinery, which is run at an immense speed, enabling them to secure almost the whole of the very small and extra sizes of iron, which they throw off at little more cost than the Welsh manufacturers do their common bars. It is in South Wales that the furnaces and manufactories produce the greatest quantity; in Shropshire and Staffordshire that the highest excellence in rolling has been attained.

In 1806, a bill was brought into parliament by Lord Henry Petty, having for its object a tax of L. 2 per ton on all pig-iron made. This measure, which exhibited throughout a remarkable ignorance of the nature and minutiæ of the iron trade, excited at once a determined opposition, and was at length abandoned. Had it been carried into effect, the price of all kinds of ironmongery would have risen to an enormous extent; as will be obvious, from the following statement in reference to common nails. At that period, ten tons of pig-iron were required to make five tons of nails; shewing, in the various processes of puddling, rolling, slitting, forging, &c. a loss of precisely one-half the material. Thus, with intermediate expenses, the proposed tax of L. 2 would have advanced nail-rods at least per ton L. 4, 10s. Six tons of nail-rods would therefore have cost the nail-ironmonger more than he was then paying, about L. 27, which, divided upon five tons of nails, is L. 5, 8s. per ton; and this laid out by the retail dealer, would have caused an additional charge of, let us say, 12s, making in all, on nails, L. 6. per ton.

This statement, which is made from one drawn up at the time, is of course not altogether applicable in the present improved state of the iron manufacture. It affords, however, a very correct exposition of what the general consequences would have been, had the tax been imposed. During the time that the project was in agitation, a great many important facts were elicited; amongst others, the annual amount of pig-iron made in the country was shewn to be at least 250,000 tons.

Since then, the manufacture has gone on increasing, although subject to great depression in 1816. For a considerable time previous to the general peace which ensued in that year, the British and mercantile navies had been continually requiring immense quantities of manufactured goods, and the sudden cessation of large orders and contracts, of course, threw a damp over the iron trade.

In 1820, it was computed that the annual manufacture of pig-iron was,

	Tons
In Wales,	150,000
Shropshire and Staffordshire,	180,000
Yorkshire and Derbyshire,	50,000
Scotland and other places,	20,000
Total,	400,000

In 1827, the make had increased by 290,500 tons, as shewn below:

	Furnaces.	Produce in Tons.
South Wales,	90	272,000
Staffordshire,	95	216,000
Shropshire,	31	78,000
Yorkshire,	24	43,000
Scotland,	18	36,000
North Wales,	12	24,000
Derbyshire,	14	20,500
Total,		690,500

of which three-tenths are supposed to have been foundry-iron. From this statement, it appears that the Welsh works are considerably more productive than those of any other district; a fact to be in part attributed to their comparatively great size.

Within these last few years, the produce of iron in Wales has greatly increased. The quantity sent down the Glamorganshire canal to Cardiff for exportation, chiefly manufactured in the immediate neighbourhood of Merthyr Tydvil in 1828, was 85,714 tons. At the same time, the shipments from the town of Newport amounted to 108,000 tons. In 1830, the iron exported was less from both places by 2000 tons; indeed the collective manufacture of this year was not more than in 1827, three years before. In 1833, the quantity exported from Cardiff was 112,315 tons, exceeding the exportation of 1828 by upwards of 26,000 tons; whilst, at the same time, the customhouse books at Newport exhibited a corresponding increase. In the year 1834, Cardiff exported 110,797 tons; of this quantity 68,420 tons were the manufacture of two works alone.

In glancing at the different iron and coalfields of Britain, it is matter of astonishment that Northumberland and Durham, possessing within themselves all the requisites for the iron manufacture, should yet be so far behind, compared with other much less favoured districts. The only way of accounting for this apparent apathy to extensive mineral treasure, is the fact, that the attention of capitalists in that part of the country has hitherto been exclusively devoted to the working and exportation of the coal alone.

Of late years, Scotland has made considerable progress in the iron manufacture. The opening out of the numerous railways through the immense coalfield in the neighbourhood of Glasgow, has brought to light strata of the richest ironstone, with coal of the most suitable quality for the manufacture of iron. A stimulus has consequently been given to the trade, which, with the general adoption of the hot-air process, promises to raise Glasgow into importance as an iron district. No town, in fact, possesses greater facilities for the sale of its produce, commanding, as it does, the east coast, London, and Liverpool markets, at two-thirds the cost of freight from either Wales or Staffordshire, and also a ready outlet to the Atlantic.

In 1835, a return was made to an order of the House of Commons, moved for by Mr Guest, containing an account of the quantities of iron imported into, and exported from, the United Kingdom in the years 1833 and 1834; also an account of the quantity of British iron, including unwrought steel, exported in the same years. From this document it would appear, that in 1833 there were 17,913 tons of bar-iron imported into this country from Russia, Sweden, and other places. In the year 1834, the quantity

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imported was 16,215 tons, shewing a decrease in the importation of the preceding year, to the amount of 1698 tons; the exportation of this description of iron in 1833 being 2024 tons, and that of 1834 being 2885 tons. The account shews an increase of exportation in 1834, as compared with the previous year, of 861 tons. By the second account it appears, that the quantity of British iron, of all descriptions, exported in the year 1833, was 160,226 tons (exclusive of 1587 tons of unwrought steel), and the quantity exported in the year 1834, being 156,456 tons (exclusive of 1709 tons of unwrought steel), there is a decrease in the quantity of British iron exported in 1834, as compared with the preceding year, to the amount of 3770 tons. This falling off in the quantity of iron exported, is to be attributed, in great part, to the difference which took place in the United States with the President and the Bank, in consequence of which, large orders for iron sent here were withdrawn. The demand for that country is now larger than ever, and continues to increase, in addition to which, the numerous railways in progress in this and other countries, have given such an impulse to the trade, that in October 1835, No. 2. iron at Cardiff was quoted at L. 7 per ton. As in some measure connected with the subject under consideration, it may be added, that in 1833, 16,497 tons of hardwares and cutlery, of the declared value of L. 1,466,361, were exported from the United Kingdom; and that in 1834, 16,275 tons of the same of the declared value of L.1,485,233 were exported, shewing a decrease in the exportation of the year 1834, as compared with 1833, of 222 tons, whilst, at the same time, there is an increase on the value to the amount of L. 18,972.

Since the introduction of the blast furnace in its present form, many improvements have been made in the various processes of the manufacture, but none of such importance as the rolling-mill and puddling-furnace, these enabling the manufacturer to increase his quantity of finished iron at will, always having a stock of pigs on hand to meet the demand of the market. Previously to the introduction of puddling and rolling (by Mr Cort in 1785), so inadequate was this country to the supply of its own demands, that it imported from Russia and Sweden, the enormous quantity of 70,000 tons of bar-iron annually, being upwards of 40,000 tons more than the importation of 1834. For several years past, numerous patents have been taken out in connexion with iron-making, bearing upon various parts of the manufacture; for instance, the application of the spare-heat from the furnaces to the roasting of ore; the use of carburetted hydrogen in smelting; the introduction of forge and refinery cinder in the blast and puddling furnaces; the use of salts of soda and potash, to shorten the process in the latter, and bring the iron, as the workmen term it, "sooner to nature." But none of the improvements here aimed at, are likely to be attended with any thing like the advantages which arise to the country from the application of heated air in smelting. This invaluable process, the invention of Mr Neilson of Glasgow, will be described in an after part of this article. It has already been adopted with immense advantage in Scotland, France, Russia, and in several of the English and Welsh iron-making counties.

The following list of prices of bar-iron, shews the fluctuations in value undergone by that article during the last twelve years:

List of Prices.

1824,	L.9	0	0	to	L. 10	0	0
1825,	10	0	0	...	14	0	0
1826,	8	10	0	...	9	0	0
1827,	8	0	0	...	9	0	0
1828,	7	10	0	...	8	0	0
1829,	5	10	0	..	7	0	0
1830,	L.5	5	0	to	L.6	0	0
1831,	5	5	0	...	5	10	0
1832,	5	0	0	...	5	10	0
1833,	5	10	0	...	6	0	0
1834,	6	0	0	...	6	10	0
1835,	5	10	0	...	7	0	0

The superiority of bar-iron, manufactured solely from mine, without admixture of cinder, is so well established, that an extra charge is usually made for it of from 10s. to 15s. per ton at the work. The workmen are generally paid a fixed price per ton on all iron made, a ton weighing 20 cwt. of 120 lb. each. The manufacturer sells it out per ton of 20 cwt. of 112 lb. each, making an allowance to the buyer of 8 lb. per ton, which is denominated drafts. This allowance is now done away with, agreeably to the 4th and 5th of William III. cap. 49; a ton of iron is therefore now only 20 cwt. of 112 lb. to each.

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II.—THE MANUFACTURE.

The manufacture of iron may be considered under two divisions; the one comprising all those particulars which relate to the production of crude or pig-iron in the blast-furnace; the other, a detail of the operations at the forge and rolling-mill, whereby the pig-iron is rendered malleable, and brought into a state fit for the manufacturing consumer.

The blast-furnace as generally used throughout this country, is a large mass of masonry, most frequently square, though sometimes round at the base, from which the walls are carried up slightly inclined to the vertical, thus forming externally a truncated pyramid or cone. At each side is a large arched opening, so placed for the more convenient insertion of blast-pipes, and for running out the melted metal. At the top is the tunnel-head, a cylindrical erection of brick-work, having one or more doors, through which the furnace is charged with the materials to be smelted. In front of the furnace a roof projects from the wall, beneath which is a bridge or cast-house, where the metal, being run into moulds of sand, forms pigs.

Plate CCCIX. fig. 1. is a section of a blast-furnace, in which the space marked A represents the hearth; CB the boshes, which in principle have been already explained; D the body of the furnace; E the tunnel-head with charging doors of iron; F F F the blast-pipes, entering just beneath the boshes, through small spaces in the brickwork, called tuyeres. Fig. 2. is a ground-plan corresponding with the above section. The greater part of the interior of the furnace is lined with fire-brick, between which and the masonry, a thin stratum or packing of sand is laid. In Wales the materials employed in the construction of the hearth and boshes, is a very infusible plumpudding-stone or quartz conglomerate, large detached blocks of which occur on the mountains, and are familiarly known amongst the workmen by the name of Noah stones. A species of coarse sandstone, belonging to the coal formation, and exceedingly refractory in the fire, is also advantageously used. Slight variations from the form of furnace here given, are of course to be met with; a point of much importance is the proper inclination of the boshes, so that the materials whilst smelting, may neither press too heavily downwards, nor yet be so much retarded, as to adhere in a half-liquid state to the brickwork, and cool there; thus forming what are known by the name of scaffolds, the removal of which is a source of great inconvenience. No general standard for the size of blast-furnaces can be given, as they vary in this respect in almost every iron-making district of Britain. The largest furnaces are those of Wales and Monmouthshire, some of which are upwards of sixty feet in height. In Staffordshire and Scotland, they are generally much less, and from thirty to forty feet in height, by about twelve or fourteen at the boshes, or widest interior diameter, may be stated as a very fair average size. Before leaving this part of the subject, it must be premised that of late years, the cupola-furnace has come extensively into use. Its characteristic feature is general slightness of structure, as compared with the more massive blast-furnace. The walls are circular, built of fire-bricks, and, excepting about twelve or fourteen feet of masonry at the bottom, in no part more than a single course in thickness; the whole, however, are strongly bound together at the joints with wrought-iron hoops, whilst pillars of cast-iron, bolted at each end to embedded rings of the same metal, rise through the foundation to the summit of the tuyere arches, giving considerable firmness and solidity to the structure. Objections have been made to the thin sides of the cupola, as permitting a great loss of heat; these, however, do not seem to have prevented its very general adoption. Cheapness and facility of construction are much in its favour, and a furnace of this kind, when blown with hot air, may certainly be used with great advantage. A cupola twenty feet high, six feet at the boshes, and three feet at top, requiring a blowing-engine of five or six horse-power, can be run up in a week, and may have iron manufactured in it the next. Plate CCCXVII. contains a section and ground-plan of a cupola furnace lately erected at an iron-work in Glamorganshire.

The communication between the ground and the tunnel head is effected in various ways. The Welsh furnaces are invariably placed on the slope of a steep declivity, which affords ready means of access. Where this convenience does not present itself, a small self-acting incline is substituted, or an apparatus is affixed to the engine by which the workmen and smelting materials are carried up and down as may be required. Attached to every iron-work is a steam-engine (or water-wheel), whose sole office is to throw a continued current of air into the furnaces. This is in most cases accomplished simply by attaching to the unoccupied extremity of the beam a piston, which is made to work in a cylinder of large diameter. At every stroke the air, entering this cylinder through proper valves in the covers, is forced into pipes inserted at top and bottom, which convey it to a large spherical vessel, built of boiler plate, whence its own elasticity causes it to flow in an equable and unintermitting stream into the furnace. Plate CCCX. shews the plan, elevation, and section of a blast-engine erected at the Wylam Ironworks, Northumberland, by the Messrs Hawthorn of Newcastle. This machine differs in many respects from the common construction, for a figure of which, in connexion with the blast furnace, see Plate CCCX. AA represent the pillar on which the engine is fixed, BB the blast-cylinder, *c c* the wind-boxes, in which are fixed the discharging valves, *d d* the blast-pipe leading to the furnaces, EE the steam-cylinder, *ff* the force-pumps, *g g* the hand or working-gear, *h h* the cross-heads, *i i i i* the slides for guiding the piston-rods, *k k* the banging-boxes.

The pressure at which the blast enters the tuyeres is from $2\frac{1}{2}$ to $3\frac{1}{2}$ lb. on the square inch of course depending on the area of the blowing cylinder, and the pressure at which the engine is working.

At the Dowlais Ironworks, South Wales, is a blowing-cylinder 12 feet in diameter, with 9 feet stroke, and worked by engines of 260 horse power. By this machine ten or twelve furnaces can be blown.

The diameter of the blast-pipes at the tuyeres is regulated by their number. Where three tuyeres are used, and the pressure is about three pounds, the diameter should not exceed $3\frac{1}{2}$ or $3\frac{3}{4}$ inches. In practice, it is necessary to be very particular with regard to this point, the well-working of a furnace depending much on the attention which is given to the blast. The best quality of cast-iron is produced by a comparatively moderate quantity of air. On the contrary, a strong and powerful blast tends to the production of a large quantity of metal, inferior in every respect, and unfit for the purposes of the foundry.

Behind the furnace, and, if possible, on a level with the tunnel-head, are placed a number of small kilns or ovens for roasting the ore. The ironstone used in the blast-furnaces of this country is a carbonate of protoxide, or more simply a carbonate of iron, in conjunction with different earths, such as alumina, silica, lime, &c. The object in roasting is to drive off the carbonic acid, water, and sulphur. The stone loses in the operation from thirty-five to forty per cent., at the same time becoming partially peroxidized. To produce iron from an ore like this, it is requisite not only that a deoxidating agent should be used, but also that there should be some other substance, such as limestone, to act as a flux, and disengage the earthy from the metalliferous particles, leaving the latter free to the carbonizing influence of the coke. The materials, then, mine or ironstone, coke, and limestone, broken into small pieces, and weighed out in the proportions which have been determined by experience to be the right ones, are introduced into the furnace by the filler, who stands at the tunnel-head, and whose duty it is to see that these proportions be observed, and that the mine and coke are properly burned. He also takes account of the number of charges required to keep the furnace full during the time of his management (twelve hours to the day); and according to this the furnace is said to drive fast or slow. The charge, or quantity introduced into the furnace at once, is a barrowful of coke, containing about twenty cubic feet, with the requisite proportions of mine and flux. These of course differ slightly at different works, according to the quality of the ore and limestone; but it is the general practice to mix rich and poor ironstones together, and thus to bring the latter material as near as possible to some approved standard, containing, say from thirty-five to forty per cent. of iron.

The general action that takes place in the blast-furnace is this: The contents being raised to an intense heat by the combustion of the coke, are brought into a softened state; the limestone parts with its carbonic acid, and, combining with the earthy ingredients of the ironstone, forms with them a liquid slag or scoria; whilst the separated metallic particles, descending slowly through the furnace, imbibe in their passage a large quantity of carbon, pass the blast without oxidation, and, in virtue of superior gravity, settle in the hearth or lowest part of the furnace, from whence, at stated intervals, the fusion is removed in the state of liquid cast-iron. The slag which floats upon the surface of the metal, whilst accumulating in the furnace, is kept constantly running off by an aperture level with the top of the hearth; and it affords well-known indications, by its degree of heat, fluidity, and colour, of the manner in which the materials in the interior are performing the parts assigned them in the operation. Thus, if the cinder has a light greyish colour, or is nearly transparent, and flows freely from the furnace, unsullied by any of the various tints of blue, yellow, and green, afforded by oxide of iron in combination with different proportions of earthy matter, a favourable state of the furnace is indicated. If, from the charge affording such results, a portion of coke be abstracted, or if to it, which is the same thing, a portion of mine be added, the cinder immediately assumes a deep brown or black colour, and flows in a broad, hot, and rugged stream, shewing that the quantity of coke is insufficient to deoxidate the whole of the iron, and that a portion of it, consequently, to the great detriment of the furnace yield, is combining in its state of oxide with the slag, to which it communicates so deep a hue.

With regard to the constitution of blast-furnace scoriæ,

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they are in general compounds of earths and earthy salts, where silica acts the part of an acid, and lime, alumina, magnesia, oxide of iron, &c. are bases. Minerals are thus formed artificially, presenting the most perfect crystalline arrangement, and similar in every respect to some native silicates. Indeed, without mentioning the graphyte or kish which scales from the surface of newly-cast foundry pigs, the splendent copper-coloured cubes of metallic titanium so abundant in breaking up old furnace-hearths, or the dark blue crystallized metallic-looking compound of sand and oxide of iron, the slag from the bar-iron heating furnace, the rejected products of the iron manufacture present perhaps more features of interest to the mineralogist than the residua of any other chemical operation.

During the process of smelting, the interior of the furnace requires to be very carefully watched. The stream of cold air that is constantly rushing through the tuyeres exerts a chilling agency on the melted matter, directly opposed to it, at its entrance. The consequence of this is, the formation of rude perforated cones of indurated scoria, stretching from either side horizontally into the furnace, each one having its base directly over the embouchure of a blast-pipe.

When these project only to a certain extent, they are favourable to the working of the furnace, as the blast is thrown right into the centre, and prevented from flowing up the sides and burning the brick-work.

Sometimes, however, when the furnace is driving cold and slow, these conduits of slag become so strong, and jut out so far as to meet at length in the middle, and thus cause a great obstruction to the entrance and ascension of the blast. When this happens, there is no remedy but to increase the burden, that is, to add more than the usual proportion of mine to the charge; this causes an intense heat, the furnace is said to work hot, and the tuyeres of slag drop clean off from the sides. But this is followed by bad as well as by good consequences; the brick-work is frequently melted, and for a time the iron produced is small in quantity, and of the worst quality.

To bring the furnace again into its proper state, it is now necessary to reduce the burden; the sides, in consequence, become gradually cool, new tuyeres are formed, and the iron produced is good.

At the end of every twelve hours, more or less, the furnace is tapped, that is to say, the aperture in the damstone, which, at the commencement, had been stopped up with a mixture of loam and sand, is re-opened, and the metal, the contents of the hearth, allowed to flow out into moulds made in the sand, of which the cast-house floor consists, thus forming a cast or sow of pigs. When this operation ceases, the damstone is again secured, and the work proceeds as before. In this manner a furnace is kept continually going, night and day, and never ceases to work until repairs are necessary. Incessant action has even been thought essential to the successful carrying on of an ironwork; but the example of perhaps the largest iron-master in South Wales has shewn, contrary to general practice in that district, that smelting may be discontinued for at least one day in the week without any very serious derangement of operations.

At Merthyr, in Glamorganshire, the yield, or quantity of materials required to make a ton of pig-iron, is as follows: 55 cwt. of roasted mine, 25 cwt. of limestone, and $2\frac{3}{4}$ tons of coal. The charge, or quantity of materials introduced into the furnace at once, is 7 cwt. 2 qrs. of roasted mine, one barrow of coke containing about twenty cubic feet, with 3 cwt. 1 qr. 15 lb. of limestone. In all cases, the regular rule is to fill in the coke first, then the flux, and lastly the mine or ironstone. In the Glasgow district, the charge is $4\frac{1}{2}$ cwt. of coke, 3 cwt. of ironstone, 1 cwt. 7 lb. of limestone; total, 8 cwt. 2 qrs. 7 lb. In a furnace twelve feet at the boshes, fifty of these charges, in twelve hours, produce $4\frac{1}{2}$ tons of iron; the same proportions have been known to produce as much as $5\frac{1}{2}$ tons, and as little as $3\frac{1}{2}$. Again, the iron is not always of the same quality; thus exemplifying different states of the furnace, blast, management, &c. In three successive casts of a furnace, in which the amount of charges was, in each case, coke, 11 tons 5 cwt.; ironstone, 7 tons 10 cwt.; limestone, 2 tons 13 cwt.:

The first cast produced	4 tons	10 cwt.	of No. 1. iron,	
second do.	4 ...	12 ...	No. 2. do.	
third do.	3 ...	16 ...	No. 3. do.	

Two different qualities of cast-iron are frequently the product of the same cast. The best kind runs first from the hearth; and the pigs are distinguished from each other by the striæ or furrows formed on their surfaces in cooling, No. 1. preserving a smoother surface than No. 2. or No. 3. pigs.

The following are comparative estimates of the cost of making pig-iron in the neighbourhood of Merthyr, South Wales, and in the neighbourhood of Glasgow:

At Merthyr.

3 tons 7 cwt. 0 qrs. of	Mine (raw), at 10s.	L.1	13	6
2 ... 16 ... 0 ...	Coal, at 6s.	0	16	6
1 ... 5 ... 2 ...	Limestone,	0	1	4
	All other charges,	0	9	1
		L.3	0	5

Glasgow District.

3 tons 10 cwt.	Mine (raw), at 4s. 6d.	L.0	16	3
5 ... 15 ...	Splint-coal, at 2s. 5d.	0	14	0
0 ... 14 ...	Limestone, at 3d.	0	3	6
1 ... 10 ...	Coals for the engine,	0	3	0
	All other charges,	1	1	0
		L.2	17	9

Both of these estimates presume the iron to be made with cold air, coke, and the mine roasted in the usual way.

The process of smelting iron, even on the large scale of manufacture, where tons of the raw material are subjected to an intense heat in the blast furnace, is an operation affected in the result by more delicate circumstances than is generally supposed. The proportions of the materials must, as we have seen, be in every case most accurately determined; and even then, with his furnace in good order, the tuyeres of the right length, and the blast steady and regular, is it difficult for the founder to predicate the quality of the resulting iron. With the same charge, the same blast, the same furnace, and the same management, the pigs may be of the very best quality, or of the very worst.

There are other questions to be taken into consideration, as, for instance, What is the season of the year, the direction of the wind, the hygrometric state of the atmosphere? For it is a fact well warranted by experience, that all these circumstances affect the working of a furnace.

A furnace will produce, on an average, more and better iron in winter than in summer; the atmosphere being of a higher temperature in the latter season, and consequently capable of holding a greater quantity of moisture in solution. To this greater or less degree of humidity in the air supplying the blast-cylinder, is to be attributed the difference of product so generally observed at different periods of the year. There are many facts confirmatory of this. Thus, to regulate the influx of blast to the furnace, a machine called a water-regulator was formerly much employed, and, indeed, is not yet entirely done away with. The principle of this apparatus, as in the common gasometer, is by the pressure of a column of water, to produce an unintermitting stream of air from a large vessel into which it is forced by the blast-engine. The water-regulator has fallen

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Cast-iron, as it comes from the furnace hearth, is by no means a pure carburet of iron. The nature of the process is such as to render it liable to an intermixture of various extraneous ingredients. Thus, in newly cast pigs, fragments of charcoal, undecomposed ore, and earthy matter, can in general be detected by the eye alone; whilst analysis as generally makes known the presence, in greater or less proportion, of manganese, sulphur, or phosphorus. Three principal varieties of cast-iron exist, distinguished from each other in various particulars of colour, strength, and general capability of adaptation to the purposes of art. Grey, or No. 1. pig-iron, is comparatively dark coloured, and when broken, exhibits a large open grain. It is easily rendered fluid, runs freely and with such facility into moulds, that it is the sole material of all the smaller and more delicate sorts of foundry goods, which, when composed of No. 1. metal alone, are distinguished by great smoothness on the surface. It is tough, slightly capable of extension, and so soft as to admit of filing, chipping, turning, &c.; hence it is of extensive application in the formation of machinery, particularly such parts as are small, and require much fitting up. White, or No. 3. pig-iron, is in every respect precisely the reverse of what has just been stated concerning No. 1. It is characterized by its white silvery-like lustre, more crystalline structure, and by a brittleness so excessive, that it cracks like glass on any violent blow, or sudden alternation of temperature. The file glances from its hard and flinty surface without making any impression; and its fluidity, when melted, is of so viscid and imperfect a kind, that it runs with comparative difficulty into moulds. No. 2. or mottled cast-iron, is a variety seemingly intermediate between Nos. 1. and 3. Its colour, as the name imports, is not equable, but blends in unison two distinct shades of grey, which, individually, are those of Nos. 1. and 3. The degree of hardness is greater than in No. 1, though less than in white pig-iron. In this metal we find united, to a certain extent, the qualities of hardness and toughness. When mixed largely with No. 1. iron, a proper material is furnished for artillery, steam-engine cylinders, &c. In fact, by melting the different varieties of cast-iron together in various proportions, the founder is always able to procure a material suited to his purpose, whatever be the property required. This is also in some measure accomplished by the diversity of character belonging to iron from different districts. Thus the Staffordshire metal is generally remarkably fluid, and makes excellent small castings. The Welsh pig-iron is strong, and produces bar-iron of a very tough and good quality; whilst the Derbyshire, the Shropshire, the Scotch, and other irons, all differ in like manner, each being distinguished for the possession of some property not common to the rest.

From what has been said, it will be seen that grey and white cast-iron are more especially distinguished from each other. The different aspects which they assume in every particular, such as colour, strength, and fusibility, was long accounted for by supposing the grey metal to be more highly carbonized than the white. From experiments, however, of good authority, it would appear that, so far from this being the case, there is actually, in many instances, an appreciably greater quantity of carbon in the white than in the grey. Respecting the wide diversity in external appearance and physical properties which the metals exhibit, chemists are disposed to attribute it to the mode of combination of the constituent elements, rather than to any absolute difference in amount of carbon; and they say that *there is no essential difference* in this respect, for these reasons, that the white variety may be changed into the grey, by exposure to a strong heat, and cooling slowly; whilst the grey may be changed into the white, by being heated and rapidly cooled.

The latter circumstance, indeed, is no matter of speculation, being frequently taken advantage of in the arts, as presenting a convenient method of case-hardening wheels, rolls, plating anvils, &c., to effect which, it is simply sufficient to run the metal into a thick cast-iron mould, instead of one of loam or sand. This process is called chilling. As a mould, malleable iron, when the required shape can be given to it with facility, is preferable, because, being a better conductor of heat, it chills the metal in contact with it more rapidly, and is less liable to crack from the sudden change of temperature. That there is a difference in the mode of combination of the constituents in grey and white cast-iron, amply sufficient to account for the diversity in mechanical properties which they present, experiment testifies. "According to Karsten, the carbon of the latter is combined with the whole mass of iron, and amounts, as a maximum, to 5.25 per cent.; but in some specimens, its proportion is considerably less. The former, on the contrary, contains from 3.15 to 4.65 per cent. of carbon, of which about three-fourths are in the state of graphite, and are left as such after the iron is dissolved by acids; whilst the remaining fourth is in combination with the whole mass of metal, constituting a carburet, which is very similar to steel. Grey cast-iron may hence be regarded as a kind of steel, in which graphite is mechanically mixed."[1]

The first operation which cast-iron undergoes in rendering it malleable, is that performed in the refinery, the object of which is to drive off a portion of the carbon.

The refinery is a small, low furnace, with a hearth of fire-brick, about three feet square. There are two sides of cast-iron, opposite to each other, and made hollow, so as to allow the passage of a constant stream of water through them. This is necessary, in consequence of the intense heat to which they are subjected, and which, were there no such protection, would speedily burn them through. Each side is furnished with three water tuyeres, in which as many blast-pipes of an inch in diameter are inserted. The front of the furnace is left open, but at the back are iron doors, through which the hearth is charged with the necessary complement of pigs and coke. A low, hanging chimney surmounts the hearth. The description given is that of the double refinery; in the single refinery, the blast enters only at one side.

The pigs to be refined being placed with the necessary proportion of coke on the hearth, are brought into a state of fusion, and the blast, which enters here at the same pressure as with the smelting furnace, is kept in action, until a considerable quantity of carbon has been burned out. The metal is then run from the hearth into a shallow oblong mould of cast-iron, about eight feet by two feet, which is kept cool by water running underneath. During the continuance of the operation, a lambent blue flame plays on the surface of the fused metal, indicating the combustion of carbonic oxide; and when the metal is run out into the mould, a quantity of scoria, or oxide of iron, collects at the top and floats there, a necessary consequence of the unequal rate of contraction in the two substances.

In the refinery, then, there are two effects produced. Carbon in moderate quantity is separated from the general mass of the iron, whilst, at the same time, a portion more

[1] See Turner's *Chemistry*, 5th edition.

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exposed than the rest becomes decarbonized to such an extent as to be free for combination with the oxygen of the atmosphere; and hence the production of cinder, which, it must be remembered, is also partly owing to impurities existing originally in the pigs. The metal which works with the least trouble, and to the greatest yield in the refinery, is No. 1, or grey pig; next to it stands No. 2, or mottled. As for white cast-iron, they are obliged to mix it largely with pig of a superior quality; when alone, it becomes thick, and does not flow readily from the hearth. The time from the commencement of the operation to the "running-out," varies a little with the kind of metal and strength of blast employed; it may be said to average about two hours. The yield of coke and metal also varies in the same manner, and much depends on the attention of the refiner. Taking the best grey pig, the average yield to the ton of refined metal may be stated at 22 cwt.; the quantity of coke consumed will be from 9 to 10 cwt.; the charge or quantity of metal worked off at once is 25 cwt. Below are actual practical statements of the refinery yields at one of the largest works in Merthyr.

In the year 1823,

	Tons.	cwt.	qrs.		Cwt.	qrs.	lb.		Cwt.	qrs.	lb.
Refined Metal made in April, . .	975	9	2	Yield	22	1	15	Yield of coal,	9	1	26
May, . .	1015	10	2	...	22	2	25	... ...	9	1	22
June, . .	885	10	0	...	22	2	22	... ...	9	1	20
July, . .	946	15	0	...	22	2	4	... ...	9	0	2
August, .	942	16	0	...	22	0	6	... ...	9	2	6
September,	971	15	2	...	22	1	10	... ...	9	1	20
October, .	996	19	2	...	22	1	0	... ...	9	0	12
Average yield on	6734	16	0	is	22	1	0	Average coal,	9	1	8

In the year 1824,

	Tons.	cwt.	qrs.
The quantity of pigs used was . . .	14,073	9	3
Finers' metal produced, ...	12,592	11	2
Total waste on 14,073 tons 9 cwt. 3 qrs. .	1,480	18	1

Shewing the average yield to have been 22 cwt. 2 qrs. 24 lb. of pigs to the ton of refined metal.

	Cwt.	qrs.	lb.
In the year 1825, the yield was . .	22	1	2
1826, ...	21	3	1
1827, ...	21	3	8

And the yield continues much the same to the present day, the chief saving being made in the puddling-furnace; a portion of which is, however, again lost in the mill-furnace.

Refiner's metal is totally unlike the pig from which it was produced; it is as white as or whiter than No. 3. cast-iron, and so brittle as to be broken in pieces by a single stroke of a hammer. It is in fact, in every external particular, so similar to white or No. 3. metal, that, for some inferior kinds of iron, the refining process is altogether omitted, the metal as it comes from the blast-furnace being merely run into moulds of cast-iron, which, as before explained, chills, and renders it hard, brittle, and white. A considerable proportion of forge-pigs, as they are called, undergo no other refining process than this, if that can be called refining, which probably merely alters the arrangement of the elementary molecules, without removing a particle of carbon. The plate of refined metal is always more or less honeycombed and cellular on the surface. When this fretted and unsound texture extends to any great depth, the plate does not puddle well; it is pointed out as too much blown to be good.

The cinder or scoria produced during the refining of iron, formerly accounted of little or no value, is now made to reproduce great part of its iron in the blast-furnace. For this purpose, however, it is necessary to mix it very largely with earthy matter or common mine; because, when smelted alone, it is found, as seems also to be the case with the pure native oxides, to burn the furnace, and to produce the most ineffective result, both with regard to quantity and quality of yield. Made use of even in sparing proportions, the metal produced is rarely No. 1, or foundry-iron. The quantity of cinder generally used in the Welsh furnaces, is from 5 to 6 cwt. to the ton of good calcined mine; and, of course, the proportion of limestone to the charge need not be so much as usual. As the refiner finishes his plates of metal, they are weighed, and, if there be no stock on hand, carried directly to the puddling-furnace, where they lose carbon to a still further extent. Refined metal is said, like steel, to improve in quality by exposure to the atmosphere, and to be better fitted thereby for the next operation which it undergoes. Accordingly plates of metal which have been on hand for any length of time are preferred by the puddler; They work more easily, and produce a better quality of bar-iron, than if puddled directly from the refinery.

Puddling is performed in a common reverberatory-furnace, of which Plate CCCIX. figs. 3, 4, 5, are a section and elevation. In fig. 3, *a* is the grate, supplied with fuel by an aperture, also marked *a* in fig. 4, called the stoke-hole; and *b* is the body of the furnace, where the gradual narrowing of height, by means of the arched ceiling, causes the flame in every part to beat on the hearth, or material placed there to be heated. C C, figs. 3 and 4, is a door of iron, through which the puddler charges his hearth, and performs other manipulations incidental to his process. It is opened and shut by raising or depressing the lever, to which the chain *d* is attached. The sides of the furnace are large plates of cast-iron, lined with firebrick; the plates E are protected from the heat, by having their lower sides immersed to a certain depth in a metal groove or socket, around which water is kept flowing. The hearth is of cast-iron, covered with a glaze or coating of finery cinder, to protect it from fusion. After the puddler has brought his furnace to the necessary temperature, he introduces his charge of metal broken into

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small fragments, at the same time regulating the influx of air through the grate and stoke-hole, by means of the damper in the chimney, so as to produce a most intense heat. In about twenty minutes, the charge begins to shew signs of melting; and the whole being brought into a state of fusion, the puddler, with a long iron hoe-shaped instrument, keeps stirring up the imperfectly liquid mass, and incessantly presenting fresh surfaces to the action of the fire. Whilst he thus operates with the metal, it heaves and swells, and emits flashes of blue flame, shewing, as in the refinery, the formation and combustion of carbonic oxide. The stirring being still vigorously kept up, all appearances of an elastic fluid at length cease, the metal becomes curdy and clotted, and so totally deprived of cohesion, as to crumble away beneath the instrument of the puddler like dry earth.

The damper, which had been nearly shut, is now raised, fresh fuel is put on the fire, and an intense heat begins again to be excited. At this stage the puddler occasionally throws a little water on the charge, which now, in a fine granular state, is said to be coming round to nature, and as the temperature rises, every exposed point of surface assumes the vivid whiteness of welding iron. Presently the separated particles begin to coalesce, and to form into small masses, which work more and more heavy, until the whole are at length fashioned by the puddler into rude balls or blooms, which are carried at once to the shingling forge and rollers, there to be beaten and drawn into bars. The charge introduced into the puddling-furnace is 4 cwt., either wholly of refined metal, or mixed with a portion of No. 3, or forge-pig. The best kind of iron is produced without any the least particle of cinder or oxide being used; but the temptation to make profit is so irresistible, that the iron-master allows his puddlers to introduce a large portion of cinder from the forge and rollers, to improve the yield. The consequence is, that the quality of the iron is deteriorated, whilst the puddler frequently brings as much or more iron out of the furnace than his charge of metal amounted to.

White cast-iron also, and forge-pig, when used in large quantity, tend to the production of a weak and inferior kind of iron; nor is this the only disadvantage attending their employment, the waste which they are subject to being very great. A considerable degree of certainty is given to the puddling furnace results by the previous operation of the refinery, because there the different qualities of cast-iron, blended in proper proportions, are reduced to one common standard, comparatively uniform in texture, and always presenting to the puddler a sameness of constitution in the material which he employs. Using cast-iron indifferently as it came from the blast furnace, was the great defect of puddling when first introduced; nothing connected with the operation could be reckoned on with safety; the waste was great, the quality of puddled iron irregular, and the duration of the process tedious. Notwithstanding this, however, it has of late been attempted to run the iron directly from the smelting into the puddling furnace, omitting the refinery altogether. Furnaces constructed with this view, have been erected in Staffordshire.

The toil and labour of puddling is excessive, and the men require to be frequently relieved; four sets or shifts of men, each set being six hours in and eighteen out, will run twenty heats, or from 80 to 85 cwt. in the course of the day. To effect this, the furnace ought to be double, or so contrived that, whilst one charge is puddling, a fresh one is heating and preparing for the same operation.

Three qualities of British bar iron are recognised in commerce, No. 1, or puddled iron; No. 2, and No. 3. A tough and fibrous quality called cable iron, is also made. The manufacture of these will now be shortly described.

The rough balls of iron, just as they are formed in the puddling furnace, are carried directly to the shingling forge, where they are knobbled into oblong blooms, and from thence, without reheating, passed successively through the puddling rolls; first through a set of gradually decreasing elliptical holes, which rough them down, then through flat openings or groves, (see Plate CCCXI. fig. 3.) by which they are formed into long flat bars, 3, 4, or 5 inches in breadth, and from one-half to three-fourths of an inch in thickness. These bars are, of course, very ragged and unequal in texture, and still retain incorporated with them a considerable quantity of cinder, acquired in the puddling furnace, although much has been forcibly squeezed out by compression between the rollers. They are called No. 1, or puddled, or mill-bars, and though exported to some extent as a cheap article, are looked upon as requiring at least another process before they can be called finished iron. For this purpose they are carried to a large pair of shears (see Plate CCCXII. fig 3.) where, being cut into lengths proportional to that of the intended bars, they are piled up with reference to the required thickness, and introduced into the mill-heating furnace (see Plate CCCXII.), where they are subject to a further loss of cinder or oxide, which, combined with sand, runs from the furnace in a fluid state. A period of from fifteen to twenty minutes is sufficient to bring the piles to a welding heat; they are then carried to another set of rollers, similar to those first described, and from thence to the finishing rollers, where they receive the most perfect form and accurate dimensions. These constitute No. 2. bars; when cut up, piled, reheated, and again passed through the rollers, No. 3. bars are formed, and the iron may then be said to have arrived at the maximum of strength and value possible to be given to it in the actual processes of manufacture; that is, supposing it to have been made from pure mine alone, without any admixture of cinder, either in the smelting or puddling furnaces. It must indeed be kept in mind that the best iron is invariably that which has been produced from the purest materials. If the ironstone or coke is bad, if they contain sulphur, phosphorus, arsenic, or any other equally deleterious ingredient, it may safely be pronounced that the pig-iron will be bad, that the refined metal will be bad, and that the bar-iron, no matter how many times it may have been hammered, rolled, heated, piled, and rerolled, will still be accompanied by the refractory ingredient which existed in the raw material.

There is undoubtedly a practical limit to the good effect produced in iron by beating and drawing out. All that rolling does, is merely to squeeze out the cinder and impure matter, blended with the rough bar, and thus to force the fibres into a more perfect state of juxtaposition. The strength which such a process imparts, is thus due entirely to a mechanical cause, and iron which has undergone the operation may be indeed very tough and flexible at a certain temperature; but cool it below, or elevate it above this, and you bring it within the sphere of a new and hitherto quiescent power; the deleterious substances, originally in the ore, come into play, you find that the iron is either cold-short or hot-short, and in fact that the whole of its good qualities are gone. In contradistinction to this, an iron that has been smelted from the most suitable and purest materials, and has gone through the usually prescribed course of manufacture, will be not only mechanically but chemically good. Its malleability will not be limited to one range of temperature, and its strength and toughness will be owing not more to the agency of rolling, than to the absence of all substances, by which such qualities could possibly be impaired.

In the contracts of the Admiralty for chain cables for the British navy, it is stipulated as an express condition, that "the iron shall have been manufactured in the best manner from pig-iron, smelted from ironstone only, and selected of the best quality for the purpose, and shall not have received in any process whatever subsequent to the

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smelting, the admixture of either the cinder or oxides, produced in the manufacture of iron; and shall also have been puddled in the best manner upon iron bottoms, and at least three times sufficiently drawn out at three distinct welding heats, and at least twice properly fagotted."

The following is a table of the breaking proof of chain cables, and of the iron for the purpose of making them; also of the proofs required by his Majesty's navy for chains.

Size of Bolt.	Proof of Bolt.		Proof of Chain.		Navy proof of Chain.
Inches.	Tons.	Cwt.	Tons.	Cwt.	Tons.
$\frac{1}{2}$	5	7	8	11	$4\frac{1}{2}$
$\frac{5}{8}$	8	7	13	4	$5\frac{1}{2}$
$\frac{3}{4}$	12	1	19	5	$10\frac{7}{8}$
$\frac{7}{8}$	16	4	26	5	$13\frac{3}{4}$
1	21	8	34	5	18
$1\frac{1}{8}$	27	2	48	15	$22\frac{3}{4}$
$1\frac{1}{4}$	33	10	53	11	$28\frac{1}{2}$
$1\frac{3}{8}$	40	10	65	0	34
$1\frac{1}{2}$	48	4	77	0	$40\frac{1}{2}$
$1\frac{5}{8}$	56	11	90	10	$47\frac{1}{2}$
$1\frac{3}{4}$	65	12	105	0	$55\frac{1}{8}$
$1\frac{7}{8}$	75	6	120	10	$63\frac{1}{4}$
2	85	14	137	0	72
$2\frac{1}{8}$	96	15	155	0	$81\frac{1}{4}$

Besides the three varieties of bar-iron which have been noticed, several works, chiefly in Wales and Gloucestershire, make a very tough and strong quality called charcoal-iron, chiefly used for the manufacture of tinned plates, and of horse-shoe nail-roads. Charcoal-iron is made from the best pigs, and refined in the usual way; but, as a substitute for puddling, it undergoes a second refining process, in which charcoal, not coke, is used; the resulting bloom is taken to the forge hammer, drawn out into a slab, and is then ready for the manufacture of this plate.

The great defect of bar-iron, as before hinted at, is the limitation of malleability to one temperature. Cold-short is the term applied to iron which is brittle when cold, though malleable at a red heat. The defect is generally owing to the presence of phosphorus, but may be occasioned by remaining too long in the furnace.

Silica also renders iron cold-short. Thus, in producing a welding temperature, it is common to throw a little sand on the parts most exposed to the heat. A slag is thus formed on the surface which protects iron from wasting; on this account, however, that part of a bar where a weld has taken place, will always be found to be more brittle than any other. Red-short iron is malleable enough at common temperatures, but liable to crack and fly, when punched or beaten at a red heat. This quality is at once detected in giving to a bar any particular form. Thus, in turning links (which is done by machinery), numbers are frequently to be rejected on account of cracks at the outside of the bend.

The waste in the balling or heating furnace is much the same, whether Nos. 1 or 2 bars be taken; but the production of cinder ought seemingly to be greatest in the case of No. 1, as being a much more impure material, and such probably would be the case, had not puddled bars a comparatively loose and open texture, in consequence of which they are sooner heated, and remain a shorter time in the furnace. Sixteen tons, 7 cwt. 3 qr. 7 lb. of No. 2 iron were cut down, piled, heated, and rolled into bars; the produce weighed 15 tons 7 cwt. 3 qr. 7 lb., and consequently the yield to the ton was 21 cwt. 1 qr. 12 lb. Speaking generally, bar-iron may be said to work to a waste of from 1 to $1\frac{3}{4}$ cwts., allowing for differences in the purity and heating power of the coal, sizes of piles, &c.; for, when the pile or billet is very small, there will be a greater waste proportionally to the comparatively greater surface exposed in the furnace; and this, with increased trouble and loss of time in rolling, enhances very much the price of the smaller descriptions of iron.

From what has been said of the various deteriorating circumstances which are incidental to the manufacture, it will readily be conceived that bar-iron is by no means regular in quality. The following trials of round-iron, performed in the years 1832, 1833, and 1834, present some curious results, and certain cases particularly would seem to indicate that the having gone through an additional process of rolling, is not always a guarantee of superiority. The iron was all of Welsh manufacture, though from different companies, and the experiments were made in a testing machine on the lever principle.

Result of Experiments on the strength of Iron, intended for Chain Cable.

December 10. 1832.

$1\frac{1}{4}$ in bolt, in the state of No. 3, cable (mine) iron, broke with $30\frac{1}{2}$ tons.

$1\frac{1}{4}$ in bolt, the same material, but put through another process, $31\frac{1}{2}$ tons.

$1\frac{1}{4}$ in bolt, in the state of No. 3, cable (mine) iron, broke with $32\frac{1}{2}$ tons.

$1\frac{1}{4}$ in bolt, another trial, $31\frac{3}{4}$ tons.

January 5. 1833.

$1\frac{1}{4}$ in bolt, in the state of No. 2 (mine) iron, broke with $34\frac{1}{2}$ tons.

$1\frac{1}{4}$ in bolt, in the state of No. 2 (mine) iron, broke with 31 tons.

January 11.

$1\frac{1}{4}$ in bolt, in the state of No. 2 (mine) iron, broke at $34\frac{1}{4}$ tons.

$1\frac{1}{4}$ in bolt, in the state of No. 3 (mine) iron, broke at 31 tons.

Two trials of these with similar results.

January 11. 1833. Continued Experiments.

$1\frac{1}{4}$ in bolt, in the state of No. 3 (mine) iron, broke with $32\frac{1}{2}$ tons.

$1\frac{1}{4}$ in bolt, same material as the last, but put through another process, broke at $32\frac{1}{2}$ tons.

$1\frac{1}{4}$ in bolt, in the state of No. 2 (mine) iron, broke with $23\frac{1}{2}$ tons.

$1\frac{1}{4}$ in bolt, in the state of No. 2 (mine) iron, broke with $32\frac{1}{2}$ tons. The latter bolt had been previously, when in the state of No. 1 iron, rolled down much smaller, and was consequently more worked in the roll.

January 14. 1833.

No. 1. $1\frac{1}{4}$ in bolt, in the state of No. 2 (mine) iron, broke with $32\frac{1}{2}$ tons.

No. 2. $1\frac{1}{4}$ in bolt, in the state of No. 2 (mine) iron, broke with $30\frac{1}{4}$ tons.

These bolts, No. 1 and No. 2, were the produce of one pile, laid up above the ordinary size. After the pile was heated carefully, and roughed down to three inches diameter, it was taken to the shears and divided into two pieces. The No. 1 piece was instantly, and at the same heat, rolled off; the other half was rolled into a flat bar at the same heat. It was then cut down, piled, and rolled into a bolt, and on subjecting both pieces to the testing machine, it appeared to support a less strain than the No. 1 bolt.

One of the great advantages of the present system of manufacture, as compared with that of some fifty or more years ago, is the facility and cheapness of rolling. At

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every great ironwork it has become necessary to have not only rolls for the manufacture of bar, bolt, and square iron, but also for numerous other articles, such as railway bars, boiler plates, sheet-iron, hoop-iron, &c. Slit nailroads are made with great dispatch, a number being cut at once from a thin bar of iron, which is passed hot between revolving cutters (see Plate CCCXIV. figs. 1 and 2). Boiler-plate rolling is most laborious work. The plate is rolled from a slab prepared previously under the forge hammer, and weighs generally from 1 to 4 cwt. Instances have been known of the slab weighing so much as 11 cwt.; the passage of so large a mass of matter between the rolls causes an enormous strain, and unless the mill pinions be of the strongest metal, there is great risk of their breaking. The various shapes and forms of rolled and hammered iron, turned out by an ironwork in active operation, are numerous beyond description. Any peculiarity of form suggested by the engineer, if the inducement be strong enough, is sure to be accomplished in some one of the many ironworks in the kingdom, and that with a dispatch and cheapness of execution which it would once have been thought impossible to attain. Shafts and beams, weighing from 3 to 4 tons, are now manufactured under the forge-hammer in from three to four days, that thirty years ago would have employed from fourteen to sixteen men for as many weeks. An establishment capable of throwing off weekly 200 tons of finished bars, bolts, boiler plates, sheet-iron, nailrods, cooper's hoops, &c. will require five blast furnaces; this is, supposing nearly 1¼ ton of pig-iron to produce a ton of bar-iron, and that a thousand tons per year are consumed as castings at the work. The necessary machinery for the manufacture of these goods are shewn in the plates annexed to this article.

Plate CCCXI. fig. 1, elevation of a puddling forge; A the forge-hammer; B the anvil-block; C the anvil; D the hammer helve; E the key or *slot* for securing the helve to F the *camring;* G the spring-block for giving effect to the blow of the hammer; H *tappet;* II cast-iron *bedplate;* K cast-iron framing supporting the camring-hammer, &c.; L framing to which the whole is secured; M carriage and axle connecting the forge and puddling-rolls. Fig. 3, elevation of puddling-rolls; AA *pinions* for connecting the forge and rolls; BB the rolls; DD standards; CC small pinions connecting the upper and lower rolls. Fig. 2, plan of the whole. Fig. 4, wood-frame or anvil-block on which the forge-anvil is supported, this is sunk into the foundation.

Plate CCCXIV. fig. 1, elevation of bar-iron mill; AA pinions connecting the upper and lower reducing-rolls FF; B clutch for throwing the rolls in and out of gear; C driving-shaft; D pinion-standard; EE coupling-boxes; GG bar-iron rolls; HH coupling-boxes connecting the bar-iron and reducing-rolls; III roll-standards; K pinion-standard; LL pinions; MM coupling-boxes connecting the slitting machinery OO; NN standards, or frame for the cutters; PP bed-plate. Fig. 2, plan of bar-iron mill and slitting machinery. Fig. 3, elevation of pinion-standard. Fig. 4, elevation of roll-standard. Fig. 6, elevation of standard for the slitting machinery.

Plate CCCXV. fig. 1, elevation of boiler-plate and sheet-iron rolls, shews different diameters of the same, according to the work required to be done. Fig. 2, plan of the same.

Plate CCCXVI. fig. 1, elevation of small bolt and rod-mill; A driving-shaft; B clutch; C coupling-box; DDD rolls for reducing the billet; EEE coupling-boxes; FFF pinions; HH coupling-boxes; GG finishing rolls. Fig. 2, plan of the same. Fig. 3, elevation of hoop-mill; AA pinions; DD rolls; C driving-shaft. Fig. 4, plan of the same. Fig. 5, end view of standard for bolt and rod-mill. Fig. 6, end view of standard for hoop-mill.

Plate CCCXII. fig. 1, elevation of wheels for bar-iron mill. Fig. 2, plan. Fig. 3, elevation of shears. Fig. 4, plan.

Plate CCCXIII. fig. 1, elevation of wheel for small bolt and hoop-mill; ABCD the several parts of the large spur-wheel; EFG pinions for connecting the rolls. Fig 2, is a plan of the same.

Figs. 3, 4, 5, 6, Back and front elevations, and plan of heating-furnace, and section of stalk for the same; A stoke-hole; B charging-door; C bridge; D stalk; E ash-pit; FF furnace bars; G hole for running out the cinder or scoria.

Having thus considered the manufacture of pig and bar iron, some details are requisite in connexion with the improved method of smelting by heated air.

The origin of the invention, with the circumstances which led to the discovery that hot air does not, as once generally supposed, deteriorate iron in a liquid state, have already been dwelt on in a preceding article (see GLASGOW). Nothing remains, therefore, but to mention some of the results which have been arrived at, and to detail the present mode of applying the discovery, which is alike applicable to smelting, refining, and to the working of bar-iron.

Plate CCCXVII. fig. 1, shews the plan of a cupola furnace in connexion with the hot-air apparatus, as at present in operation in several works in Glamorganshire; and *a*, *a*, *a*, &c. the metal pipe in which the air is heated as it passes from the blast cylinder to the cupola. At intervals along the range are placed the heating furnaces, *b*, *b*, *b*, &c., the flame and smoke from which are carried along a brick conduit or flue to the chimney, in the direction shewn by the arrows. The furnace has three working tuyeres. Near the entrance of two of these, the main pipes are laid down in a short double row, in each case, connected together by four smaller pipes, directly opposite to which are placed two of the heating furnaces.

Thus the air, on arriving here, already at a high temperature, is divided amongst several small tubes, exposing a much greater surface to the action of the fire than could conveniently be done in one single pipe.

Hence it becomes still more intensely heated, and the interval being so short, has no time to cool before entering the furnace.

With this apparatus water tuyeres are necessary, the air being heated to upwards of 612° Fahrenheit. Fig. 4. is a section of the water tuyere, shewn also in the other figures. It is merely a short duplex pipe of cast-iron, placed at the entrance to the furnace, and having a stream of water continually flowing through the interval formed by the two surfaces.

When the heating apparatus was first employed, the contraction and expansion to which the pipes were liable, from fluctuations of temperature, was so great, as very materially to derange the joints, which were then common flanches, bolted together in the usual way. Each length of pipe is now made with a small bead and dovetail groove at the extremity; and as the laying down proceeds, the joints are firmly secured by having a solid ring or fillet of metal cast on (see fig. 3).

Thus the whole range is as a single pipe, and the expansion is only felt at one extremity, where it is provided for by a stuffing-box, or enlargement of the engine blast-pipe, into which the heated air-pipe is inserted with the necessary play.

The advantage of heating the air for smelting arises chiefly from the great economy of materials produced.

This has been invariably the case wherever the improved process has been adopted, the economy becoming more apparent, proportionably with the elevation of temperature given to the air. In the first place, the consumption of coal and limestone, especially of the former, is considerably lessened. In the neighbourhood of Glasgow, the aggregate

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of materials required to make a ton of pig-iron is now little more than one-half of what was necessary when cold air was used. Much the same is the result of using the hot-blast in Derbyshire and Staffordshire. The following is an estimate of the quantity of materials required in the year 1829, to make a ton of pig-iron, with coke and cold air; and, in 1834, with crude coal, and the air heated to 612°. This statement refers only to the Glasgow district.

	With cold air.		With hot air.	
	Tons.	Cwt.	Tons.	Cwt.
Splint coal for smelting, .	5	15	2	0
Roasted mine, . . .	1	15	1	17
Limestone, ...	0	14	0	11
Coal for blowing engine, .	2	0	0	11
Coal for heating apparatus, .	0	0	0	8
	10	4	5	7

It appears from the above statement, that the expense of fuel for the blowing engine and heating apparatus, added together, does not amount to so much as did the coals for the blowing engine alone, before the heating apparatus was used, the quantity of cold air required to blow a furnace being much more than when raised to an elevated temperature, on account of the increase of volume attendant on the latter condition. To such an extent, indeed, is this the case, that blowing machines, which were only capable of working three furnaces, when cold air was used, blow with ease four furnaces, when the blast is heated to 612°.

The decrease in the requisite quantity of iron-making materials is accompanied by an increase of one-fourth in the quantity of iron produced in a given time; a furnace that with cold air made sixty tons of metal per week, now making as much as eighty tons during the same period. Whether the metal produced by the hot-blast be equal to that made in the usual way, admits of some doubt. The general opinion seems to be, that the iron is weaker, both in the pig and in the wrought bar.

There appears to be no possible reason why this should be the case, provided that coke only be employed in the blast-furnace. If the coal be used in a raw state, as it most commonly is, when the furnace is blown by hot air, then there certainly is room for suspicion that deleterious substances may come in contact with the iron, which, had the coal been coked, would, during that operation, have been in great part, if not wholly removed.

III.—ORES OF IRON, COAL, &c.

Although it is not intended in this part of the work to enter into a minute mineralogical examination of the various ores of iron; yet it seems necessary to a right comprehension of many facts and processes connected with the manufacture of that metal, that we should be acquainted to a certain extent with the chemical and physical characters of its most useful ores, and also of the fluxes and other adjuncts employed in their reduction. Notwithstanding the numerous forms in which iron occurs mineralized, and extending as it does in one or other of these, throughout the whole suite of rock formations, yet there are many circumstances which limit the sources of its supply within narrower bounds than would otherwise have existed, had there been no such difficulties to contend with. Sometimes the minuteness of the quantity, disseminated through a rock or stratum, is such as to preclude every idea of its being made profitable to the miner; whilst at other times the substances composing the ore, and existing in contact or combination with its metallic ingredient, are of a nature calculated to impart deleterious qualities to the iron with which they are associated.

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Conceding, then, to these and other similar circumstances, their due weight, it arises that all the ores actually made available to the production of iron, may be essentially comprehended under two great divisions; the one including those which, like the magnetic and specular, consist simply of iron in direct union with a greater or less definite proportion of oxygen; the other, those which, like the ironstones of secondary formations, consist of oxide of iron in union with carbonic acid, and in contact or mixture with numerous earths, &c. hereafter to be enumerated. The kind of ironstone existing in any district may in general be inferred from the geological character of the country. Thus the primary countries of Sweden and Scandinavia furnish us with the purest of all the iron-ores. In the transition districts of Lancashire and Cumberland we meet with a mineral, less, though scarcely less pure; and in the coal-fields of Europe, America, and New Holland, with the most impure, yet certainly most valuable source of iron. The iron-ore occurring in Cumberland and Lancashire is the red glance, or hæmatite. In composition it is nearly a pure peroxide, affording a small per-centage of silica, water, and, according to Chevalier, a little ammonia. It possesses in general a high lustre, assumes the reniform and botryoidal shapes, and frequently contains crystals of quartz. Its situation in Cumberland and Lancashire, at a distance from coal, precludes it from being smelted in these districts to any great amount. Hence it is shipped, in the former county, at Whitehaven, and at Ulverstone, in Lancashire, for different parts of the kingdom, where it is generally mixed with ironstone of a more meagre quality. Much ore from Workington in Lancashire is smelted in South Wales. The same material from the same neighbourhood is to be met with in Worcester, Shropshire, Staffordshire, Northumberland, Scotland, &c. The argillaceous ironstone is, with the exception of coal, the most important mineral product of our island. It is the source whence all the great iron districts of this country, Staffordshire, Wales, Shropshire, Derbyshire, Scotland, &c. derive their almost inexhaustible supplies. Occurring chiefly in the coal measures, it exists to a greater or less extent throughout the whole of the carboniferous group, forming in the different members of that series beds and layers of lenticular nodules, conformably with the other strata, which consist of argillaceous and bituminous shales, micaceous sandstones, and different varieties of clays, and coal. Every coal-field has thus the materials for the iron manufacture within its own geological limits, an abundance of metalliferous ore, coal to roast, reduce, and carbonise it, sandstone for building, refractory fireclays for the furnaces, and mountain limestone for fluxing the ore, generally at no great distance.

The ironstones of coal districts have been divided into classes, according as the different earths preponderate in their composition.

1*st*, Argillaceous Ironstone, having fine clay as its chief component earth, lime in the next proportion, and nearly destitute of silica, when properly torrefied, exhibits fibres on its internal surface, of a brown, dark brown, or claret colour, running either in streaks, or radiated and adhering tenaciously to the tongue, will afford, with a moderate proportion of lime and coke, iron of the first quality, possessing strength conjoined with an intimate degree of fusibility.

2*d*, Calcareous Ironstone, that which contains lime as its principal earthy mixture, and holds clay in the next proportion, but is comparatively unalloyed with sand; when regularly torrefied, it assumes a variety of shades, generally lighter in colour than the former class, sometimes presenting internal fibres, and adheres less tenaciously to the tongue. Its vein can always be reduced and carbonised

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with a comparatively small quantity of limestone and coke. Under this class are found those which produce iron of a fusible nature, seldom connected with strength, but valuable for fine castings, which require ornament more than durability.

3d, Those ironstones, the component parts of which are nearly an equalized mixture of clay, lime, and sand, which torrefy with a slight degree of adhesiveness to the tongue, assuming a darkened ore-brownish colour, void of every internal fibre, always afford an iron of an intermediate quality for fusibility and softness, but possessing strength in an eminent degree, and excellently adapted for artillery and the larger parts of machinery.

4th, Ironstones which unite a large proportion of sand with sparing proportions of clay and lime, and which, upon being exposed slightly to heat, exhibit masses of semi-vitrification, neither obedient to the magnet, nor adhesive to the tongue, having a refractory disposition, and possessing a dark blue or blue colour, always afford, with the usual proportion of fuel, iron of the worst quality either as to strength or fusibility. Such metal is commonly brittle, and affords malleable iron of the cold short quality.

It is a matter of fact that phosphorus sometimes exists in iron to so great an extent, as very materially to injure its malleability at low temperature, rendering it, according to technical language, cold-short. That phosphorus is actually the agent productive of this effect, was ascertained by the experiments of Bergmann and Meyer, who were invariably enabled to detect a phosphuret in iron possessing the above-named quality. The existence of phosphorus in iron is a sufficient evidence of its presence in the ores of that metal, and would lead us to infer that there was a gradual deposition of animal matter during the formation of the ironstone beds. In this inference we are amply supported by observation; for traces of animal matter have been found very extensively in ferruginous beds and nodules, traces more particularly of membranous shells, and of the scales and bones of fish.

In the Mid-Lothian coal-field, ironstone nodules are described as occurring in great number, and, when broken open, exhibiting a very curious appearance. The mass of the stone is of a dark brown colour, compact and solid; in the centre, generally occupying about an inch, is an oblong body, the structure of which is disposed in laminæ, or concentric layers. The round body, the appearance of a neck and head, the four projecting substances corresponding to legs, and the circular rings on the part corresponding to the abdomen, all evidently corroborate the supposition that the centre substance is an animal in a petrified state, or some organic substance which has served as the nucleus of the stone.

In the *Annales des Mines* for 1825, M. Berthier gives an account of his discovery of phosphate of lime, in association with the argillaceous ironstones of the coal formation at Riant in France. The specimen he examined had absolutely the same appearance as the argillaceous ore of iron with which it was found; and he adds that the fact, interesting as it may appear in a geological point of view, deserves also the notice of metallurgists, and should induce them to institute a strict examination of the ores with which the coal formation furnishes them.

The specimen of phosphate of lime, on being analyzed, gave the following result:

Lime,	0.363	Phosph. lime (Apatite),	0.670
Phosph. acid,	0.310	Carb. of Iron,	0.157
Protox. iron,	0.096		
Alumina,	0.090	Alumina,	0.190
Water, bitumen, and carbonic acid,	0.120	Water and bitumen,	0.060
	0.979		0.979

The mineral is found in nodules of a globular form, sometimes flattened, and always of rather small size; and these nodules occur in great quantity in the black argillaceous schists which separate the second bed of coal from the sandstones that support it. They are not homogeneous; their crust is almost entirely composed of carbonate of iron. Sometimes they contain a great quantity of transparent laminar carbonate of lime, which divides the mass into small prisms; sometimes it is a coally matter, and at other times they are enveloped in a crust of compact sulphuret of iron. In the centre there is a nucleus of a pale yellow or grey colour; compact, fine granular, and traversed by impressions of gramineæ. It is this nucleus which contains the phosphate of lime. The crust of a nodule, assayed in a covered crucible without addition, gave 0.20 of hard cast-iron, equivalent to 0.43 of carbonate of iron; and a slag, weighing 0.56, which was opaque, of an apple-green colour, and entirely similar to melted phosphate of lime. The ore of iron called Bog Iron Ore, which is daily forming by deposition from pools, the waters of which have previously percolated through ferruginous strata, very frequently contains a large proportion of combined phosphoric acid. The iron made from this ore is cold-short, but is excellent for producing distinct and well defined castings, as it swells in cooling. The greater part of the Berlin ornaments are made from bog-ore.

In enumerating the more general ingredients of ironstones, perhaps titanium should be noticed; which, since its first detection as a new substance at Merthyr Tydvil, where it had been supposed to be a species of pyrites, has been found in the slags of nearly every furnace in the kingdom, as well as in Germany and France, a pretty evident proof of its wide dissemination in connexion with minerals affording iron.

Whether titanium ever combines with the iron during the process of reduction, and is thereby productive of a good or bad effect, we do not feel competent to assert. It seems not improbable, that its presence in small quantities may tend to improve the quality of the iron, with which it is alloyed, in the same way that certain other hard and refractory metals, as rhodium, &c. are productive of an admirable effect in common steel. Indeed, the supposed case is not without analogy, as in reference to manganese, to the presence of which Berzelius attributes in a great measure the superiority of the Swedish over the British iron.

When magnesia exists to any great extent in an iron-ore, the infusibility of the combined mine and flux are greatly increased. Presenting itself under so deleterious an aspect, this earth is unfortunately of common occurrence both in ironstones, cokes, and limestones. On this account all the members of the magnesian limestone deposits are to be most carefully avoided.

In concluding these remarks upon ironstones, it may not be unimportant to add a few observations on coal, a mineral of so much importance in connexion with iron-making, when practised in thinly wooded countries. Of the different species of coal enumerated by mineralogists, the common varieties of the black or bituminous class appear to have been most extensively employed in smelting operations, a fact resulting not only from their more universal distribution, but also from certain peculiarities in their organization, as contrasted with those coals which approximate in character to the anthracites. Nor does this preference appear to have been conceded wholly without trial. Thus, in South Wales, the extensive development of stone-coal seams, in connexion with rich deposits of ironstone, have led to frequent attempts at using this coal in the raw state as a substitute for coke. These attempts have hitherto proved unsuccessful, a result the more unexpected, considering that the coal is a dense and nearly pure mineral

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carbon; and that the close-grained and more ponderous cokes have generally been regarded as best adapted for iron-smelting. It has been suggested that the imperfect conducting power of this mineral for heat, arising probably from the compactness of its texture and its want of bitumen, presents the obstacle, which has hitherto prevented its application with any success to processes conducted in the blast furnace. This imperfect transmitting power is so great, that the application of the blast to a furnace, in which the stone coal is placed as fuel, instead of producing ignition throughout the mass, actually extinguishes the fire.[1]

In a patent taken out some years ago, it was proposed to smelt iron with stone coal, introducing at the same time a stream of carburetted hydrogen.

The following are analyses of several varieties of coal:

	Carbon.	Volatile matter.	Ash.
No. 1,	89.00	8.00	3.00
No. 2,	82.00	14.50	3.50
No. 3,	69.00	28.00	3.00
No. 4,	85.60	13.40	1.00
No. 5,	52.45	45.50	2.04
No. 6,	52.88	42.83	4.28

No. 1. is an analysis of the Welsh stone coal.

No. 2. is an analysis of the furnace or iron-making coal of Wales. A most important and peculiar property resident in this coal is the proneness to ramification or swelling exhibited by it during combustion, which frequently gives the coke an arborescent appearance, and renders it in some varieties as light and porous as wood charcoal; whilst in others, as, for instance, the great seam at Merthyr, the coke is much harder, more ponderous, and admirably adapted for iron-smelting.

No. 3. is an analysis of the bituminous or binding coal of South Wales, many seams of which possess the important property of being free from sulphur. The coke of this coal, when it can be procured, is mixed with that of the branching coal in smelting.

No. 4. is an analysis of the great seam at Merthyr, the coal from which a great portion of the coke for the blast-furnaces is procured. It is coked in heaps in the open air, and produces a close-grained coke of a silvery lustre, and very free from sulphur.

No. 5. is an analysis of the Alfreton furnace-coal, and

No. 6. is an analysis of the Butterly furnace-coal.

Besides the ingredients indicated by the analyses here given, as constituting coal, a great number of extraneous substances are commonly blended and associated with that mineral, such as sulphuret of iron, carbonate of lime, magnesia; and these of course exercise a detrimental influence when the coke is brought to play its part in the blast-furnace.

The object in coking is to obtain the carbon of the coal in as insulated and independent a form as possible, by driving off the moisture, sulphur, and gaseous constituents. The earthy ingredients not being volatilisable, of course remain, and even the sulphur is never wholly driven off. The relative amount of these substances, as indicated in some degree by the quantity, weight, and colour of the ash, when a certain portion of coke is burnt, should in every case be ascertained before a coal is appropriated to smelting operations.

The method of coking varies in different places. In some iron districts the process is performed in small ovens, the access of air being prevented as much as possible. In South Wales, on the contrary, long heaps of coal are ignited in the open air, and allowed to burn from one end to the other beneath a slight covering of turf or ashes. After the cokes have done smoking, the cokers frequently stir the heaps, in order, as they say, to allow the escape of sublimed sulphur; and, after the ignition has continued a sufficient length of time, the burning cokes are extinguished with water, which is also said to favour the escape of sulphur; perhaps in this way. A portion of the water being decomposed by contact with the cokes at so elevated a temperature, the sulphur of the coke probably attaches itself to one of the liberated gases, and makes its escape in the form of sulphurous acid gas, or sulphuretted hydrogen. It cannot fail of being perceived, that the process here described must be of a very uneconomical nature; and, indeed, if the weather happen to be very windy, no exertions can at times prevent the loss of many tons of coal in a single night.

Rollers, Forge, &c.

Coke is of various degrees of weight and quality, corresponding in great measure with the properties of the coal from which it is derived. Sometimes it has a dull grey fibrous fracture, very similar in appearance to charcoal of wood. More generally the fracture is porous, with a bright vitreous, nay almost metallic lustre. The quantity of coke that can be procured from a given quantity of coal, of course differs considerably; so much, indeed, in different seams and in different districts, as to render it difficult to give any numerical standard on the subject.

In the Glasgow Coal-field,

1½ tons of best splint coal produce 1 ton of coke.
2 tons of inferior do. .... do.
2¼ tons of the main do. .... do.
3 tons of Pietshaw do. .... do.

And it is generally observed, amongst the manufacturers of that district, that one ton of the best Scotch coals is only equal to three quarters of a ton of the best Newcastle.

The Welsh coals, as will be seen from the comparative analyses before given, contain a much less quantity of volatile matter than either the English or Scotch; and hence their great superiority as an iron-making coal.

IV.—ROLLERS, FORGE, &c.

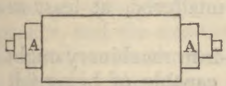
In the preceding pages we have given a description of the manufacture of iron, up to the time of producing finished bars in the rolling-mill; but as yet, nothing further has been said of the machinery employed, than the explanation of processes under consideration, rendered absolutely necessary. Supposing the manufactory in an active state of working, to turn out 200 tons of finished iron per week, it may be well to enter into some details connected with the making and fitting up of the rollers, describing at the same time that part of the establishment exclusively appropriated to this purpose. After the manufactory is furnished with the machinery in daily use, such as rollers, coupling-boxes, pinions, spindles, hammers, anvils, the parts of the different furnaces, &c., it is usual to provide duplicates of all these.

The rougher pieces of apparatus, such as hammers, anvils, the several parts of the heating furnaces, plates for the floors, &c. are run at once from the blast-furnace. On the other hand, the finish, and accuracy of size and shape, which bars, bolts, and in fact, all other descriptions of rolled iron are required to have, demand that the greatest care and attention be paid to the getting up of the rollers. They should be made in the best possible manner, and of the

[1] Foster, *Trans. Nat. Hist. Soc. Newcastle.*

strongest metal, a proper melting furnace being provided, and kept entirely for the purpose. The best coals are indispensably necessary, otherwise the work will be deteriorated by the impurities which it cannot fail to take up when in a highly heated or liquid state. The material ought to consist wholly of No. 1. pigs. A mixture of Staffordshire, Shropshire, and Welsh metal is most suitable.

The best grained rollers for boiler-plates are cast in loam or sand. The mould, which is sunk perpendicularly in the cast-house floor, is capable of containing in an upper part, at least one-third more metal than is necessary to form the roller. The object of this is, to give weight and pressure to the fluid material below, and thereby insure a perfect casting. Without this precaution, the rollers generally turn out honeycombed and unsound. It is also necessary during the running of the metal into the mould, to keep it alive, by constantly stirring it with a stick, the extra metal or head at the same time making up for any deficiencies caused by shrinking or evolution of gas in the interior of the casting. The roller, for whatever purpose it might have been intended, used generally to be cast as a plain cylindrical mass, the grooves being afterwards all cut out by the slow and tedious process of turning. It is now moulded as near as possible to the form which it ought to have when finished, allowing only as much superfluous metal as will admit of its being cleaned up, and brought to a true centre in the lathe. Rollers for boiler-plates and sheet-iron, from the great strain to which they are occasionally subjected, should have the bearing part or neck turned in the shape represented at AA.



The barrel or cylinder should also be slightly concave, because when the slab is first passed through the rollers, it comes in contact only with a small portion of the revolving surfaces. The central parts of the roller thus become highly heated, whilst the extremities are comparatively cool; the consequence is, that the expansion is greatest at the middle, so that, unless this be provided for by concavity in the barrel, the plates become buckled; that is, both warped and uneven in thickness, and consequently unfit for the purposes of the boiler builder. Bar and bolt-rolls are generally slightly case-hardened, this is effected by chilling in a mould or cast-iron case fit for the purpose. That the chilling may not exceed what is necessary, the roller, when cast, is turned out of the case red-hot. This prevents its hardening too much, and allows the turner to finish it with less injury to his turning tools.

We will now enter into a few particulars respecting the sizes of the different kinds of rollers, and the speed at which they are run. Rollers for roughing down are from 4 to 5 feet long, by 18 inches in diameter. The rollers for merchant bars and bolts are generally about 2 feet 6 inches long, 13 inches in diameter, and make about 70 revolutions per minute. With regard to boiler plate and black sheet iron rollers, much depends on the size of the work which they are to perform. They vary in size, from 2 feet 6 inches in length, by 13 inches in diameter, to 5 feet 6 inches in length, by 18 inches in diameter, the speed at which they are run varying from 35 to 40 revolutions per minute. For roughing down small iron, it is usual to run three rollers backwards and forwards; that is, the rollers run in opposite directions. These, and also the finishing rollers for the same descriptions of iron, are generally 10 inches in diameter, and make about 120 revolutions per minute. Guide rollers for small rounds and squares are 8 inches in diameter, and make about 200 revolutions per minute. In all the large works, the rollers vary as to size and also velocity; but the proportions we have here given are those in most general use. Of course, if the rollers are increased or decreased in diameter, the speed must be regulated accordingly. In some of the Staffordshire mills, guide rollers are run so small as 4 inches in diameter, with a speed equal to 400 revolutions per minute. All, except the roughing and boiler-plate rollers, are usually case-hardened. The small rollers, in particular, are fitted up with the greatest accuracy, and carefully chilled. Whilst the speed of rolling thus varies with the size and description of the roller, there is one condition which should be invariable: It is this, that the process ought always to proceed at a certain temperature, so that the particles of the iron may be compressed to the greatest possible degree, and the bar be turned out, with a clean and well-polished skin. For the general purposes of the rolling mill, the engine should be of eighty horse power. In rolling boiler plates, however, where, as was before mentioned, the slab sometimes weighs as much as 10 cwt., a hundred horse power will not be too much. The fly-wheel and shaft, to overcome the great resistance, ought to weigh from 25 to 30 tons. The whole of the boiler plate machinery should be proportionally strong, and detached from the other parts of the mill, so that, when necessary, the whole available power of the engine may be concentrated on the working of these rollers alone. The pinions, if not made of the strongest metal, are liable to almost constant breakage. The connecting spindles ought, if possible, to be made of wrought iron. At some manufactories, the coupling boxes are also made of wrought iron. The shaft of the spur-wheel, and indeed all the other shafts, should be of the same material, the bearings carefully turned, and well case-hardened. Associated with the rolling-mill should be a large and strong lathe of the most improved form and construction, with self-acting slide rests. When the mill is in an active state, this will be almost constantly employed in turning rollers, which, for railway bars and the like, require to be of an endless variety of forms and sizes.

So far the *Forge* has been considered merely as an auxiliary to the rolling mill, being employed to shingle the puddler's blooms preparatory to their passing through the rollers, and being formed into mill-bars. Something further than this seems requisite, in order to a right appreciation of this most valuable piece of machinery in the manufacture of various large and heavy articles required by the engineer. Few of the larger works interest themselves in the manufacture of iron, after it leaves the rolling-mill. This, therefore, forms a separate branch, and is carried on to a great extent in Newcastle-upon-Tyne, Birmingham, Bristol, and several other large towns in the kingdom. It is at establishments in these towns and their neighbourhoods that shafts, cranks, crossheads, and other parts of the steam-engine are forged, and that large chains and mooring anchors are manufactured, not only for the British, but also for the Dutch, Swedish, French, Turkish, Egyptian, and American navies. So low, indeed, is the price at which British iron can be produced, and to so great a degree of perfection has the manufacture of anchors and chains been carried, that these powers pay little more for the latter articles than the cost of Russian or Swedish iron in their own country.

Until forty years ago, it was not attempted to make any work under the forge-hammer exceeding one cwt. We are now indebted to the forge for the manufacture of anchor-shanks, weighing singly from 30 to 45 cwt.; arms for the same, of 18 cwt.; palms, 3 to 4 feet wide, and from 8 to 12 cwt.; steam-engine shafts, 25 feet long, and weighing from 5 to 6 tons.

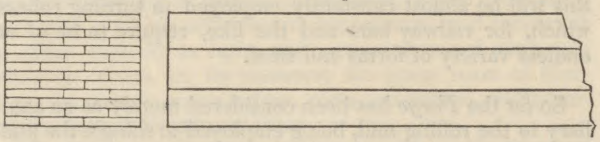
To shew the improvements which have been made in the manufacturing of machinery since 1792, we subjoin a statement of the manual labour attending the making of an anchor for the British Navy at that time and now. In the year 1792, it required 16 men, each working 27 days, to forge and finish an anchor for a first-rate ship in the navy; the anchor when finished weighing 8960 lb.; total number of days, $27 \times 16 = 432$ days. In the year 1835, with the assistance of the forge, the same quantity of work can now be finished in 173 days, making a saving of manual labour by the use of the forge of 259 days.

This statement, along with others which could be given, fully bears out the assertion, that in no part of the manufacture has so much progress been made as in the getting up of anchors and chains. In the year 1808, the sum paid for workmanship on one ton of chains amounted to L. 18; at present chain-cables can be bought for the same sum, including both iron and workmanship.

The "Sovereign of the Seas," built in 1637, carried eleven anchors, one of which weighed 4400 lb., or 39 cwt.; but the largest anchor now made for the navy weighs five tons. Fifty years ago, it was not thought possible to roll bolts and bars; at that time all the boltstaves required for shipping were rounded under the smith's hammer, from Russian and Swedish iron. In the same manner, so little were the uses of the forge understood, that it is only within these very few years that the great and increasing demand for large wrought-iron machinery for steam-boat and railway engines, has led the iron-manufacturer to attempt what had previously been thought impossible.

The forging of large machinery, which is carried on to a great extent at Bedlington, near Morpeth, is sufficiently interesting to claim a particular account in these pages. There the writer of this had the opportunity of seeing the manufacture of a large shaft for the rope-rollers of the Stanhope and Tyne Railway incline engine. It was laid up in a faggot from large flat bars, as shewn in the figure adjoining;

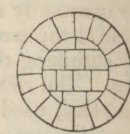
End view. Top view.



a long bar of iron, called a "Porter," being welded into the interior of the mass at one end, for the convenience of moving it about under the hammer. The weight of the iron, previous to being heated, was 7 tons 6 cwt. 1 qr. 26 lb., and the weight of the shaft, when finished at the forge, 5 tons 8 cwt. 2 qrs. 6 lb., shewing a waste in the process of manufacture of 1 ton 17 cwt. 3 qrs. 20 lb., or about one-fourth of the whole. This shaft, which was 25 feet in length, with a cross sectional area of 13 square inches, was probably the largest single piece of iron ever manufactured under a forge hammer. It was finished in eight days. Had it been made under the small hammers, according to the method of working forty years ago, it would have required as many weeks.

Messrs Maudsley and Co. of London have occasionally had shafts forged at these works near five tons in weight; the same manufactory is not less celebrated on another account, namely, as having produced the first rolled malleable iron railway bars. After the shaft has been laid up in the manner described, it is carefully heated in an air furnace, constructed for the purpose, drawn out when ready, as quick as possible, swung upon the anvil, and worked under a very heavy hammer. The better to effect this, it is slung in a cradle working on a screw, which is suspended to a collar, playing over the jib of a strong and powerful crane, capable of sustaining at least twenty tons. This apparatus suffices for the purpose of enabling the forgeman and his assistants with strong iron levers or caul-hooks, to move about and turn round their work as the operation may demand. Sometimes it is urged forwards, at others, by the combined exertions of the workmen, turned over on the anvil, each side in succession being presented to the stroke of the hammer. In this manner it is astonishing to see with what ease and facility the massive shaft is handled during the progress of the heat, which generally lasts about half an hour. At its conclusion the shaft is returned into the furnace, raised afresh to the welding temperature, another heat is taken, and so on until it is finished. It is of the greatest importance that the work be accomplished in so complete a manner, under the forge hammer, that nothing further shall be required of the smith, as the shaft in the process of forging, has acquired a stiffness, which it is desirable that it should retain. After-heating weakens it much, loosening the fibres of the iron, and destroying its elasticity. Notwithstanding all the care of the workman, and repeated heavy hammerings, few shafts are solid to the centre; indeed, it is doubtful if it be possible by any means to obtain a perfectly homogeneous mass where the magnitude is so great.

Large masses of forged and hammered iron almost invariably exhibit a hollowness at or near the central axis. It is difficult to say exactly how this arises, as a curious and important fact, however, it deserves attention. Some time ago it was customary to lay up work of the kind we have been describing with feathered or wedge-shaped bars, as in the attached figure. During the French war, most of the large anchors for the British navy were manufactured in this manner; but many of the shanks of these anchors breaking, it was discovered that only a crust or exterior rim of the shank, exceeding little more than two inches in thickness, was perfectly welded, whilst the bars in the centre, although undergoing the same degree of heat and hammering, were quite loose, and might have been taken out unaltered, at least as to shape.



All the larger pieces of wrought-iron machinery ought to be made under a heavy hammer, capable of being felt to the very centre of the pile of bars, when in a welding state, finished there as far as possible, and then passed into the lathe, planing-machine, or drill, there to be further fashioned to the required shape. If the shaft or other piece of machinery be returned to the fire for a dressing up, it becomes brittle and considerably weakened, the fibre of the iron is destroyed, and the shaft rendered less susceptible of resistance to torsion or twists, that it may be subjected to, in any particular situation; as, for instance, in a steam-boat engine during a heavy sea and hard gale.

It is to be regretted that the iron manufacturer should ever be obliged, as he frequently is, to deteriorate from the quality of a well-forged piece of machinery, for the sake of accomplishing what, with a little more expense, could be as well or better done in the lathe, at the same time without the slightest risk of injury to the iron. When a shaft, which has been fabricated under circumstances of this kind, gives way or breaks, the cause of failure is seldom traced to the right source. The manufacturer is blamed for using a bad quality of iron; the engineer, in nine cases out of ten, little thinking that to his own misplaced economy, or ignorance of the properties and manufacture of iron, is to be attributed, in great part, the misfortune.

Shafts and large machinery are best made from scrap-iron, collected in the dockyards, shops of the large engineers, coach manufactories, and other places where refuse iron accumulates. The scraps, being of various sizes and descriptions, are cut into very small pieces, called nut-iron, blended together, carefully piled upon a flat freestone plate, or, if not convenient, a fire-clay tile, and put in this manner into the balling furnace. The piles heated at once amount from 6 to 8 cwt. After remaining in the furnace about twenty minutes, they are successively taken out with a pair of tongs, thrown under the forge-hammer, and speedily shingled into slabs or blooms. These are again heated in another furnace, and rolled into bars of the shape and size required.

Scrap-iron is the most suitable material for all kinds of engine-work. It also makes the best boiler-plates, rail-bars, &c. Not being so fibrous as the best British iron, it is less liable to split or crack, bears the heat in a large body better, and makes sounder work. Some of the large iron-masters make a description of iron which they denominate scrap-iron. This is manufactured from the crop-ends of the bars, and other refuse collected in the work. It consists, consequently, of all the varieties of quality found in Nos. 1, 2, and 3 iron, the whole being blended together. The result of such a mixture is, the greatest irregularity in quality and texture. The No. 1. or puddled iron in the composition not having undergone the same working as the No. 3, does not unite or coalesce with it; the several parts of the bar have the appearance of being imperfectly welded, and exhibit splits and cracks on the edges.

On the contrary, good scrap-bars, of the description before mentioned, being made from old, and consequently well-worked iron, assume a sound and strong body; and the pieces also of which the bloom is fashioned being small, thrown together indiscriminately, and not piled regularly as the iron from crop-ends, meet together at various angles to each other; the fibres are thereby crossed, and the bar is rendered less subject to that longitudinal lamination so seriously felt in rail-bars, tyres for locomotive-engine wheels, and other similar work.

It is not by any means to be imagined that the advantages of the forge are confined to the putting together of such large masses of iron as have hitherto only been described. In fact, all kinds of edge-tools, agricultural and plantation hoes, sugar-cane bills, axes, adzes, spades, shovels, and the like, are now made with an immense saving of manual labour by the forge; the machinery for this purpose being, of course, lighter in proportion, and the hammer made to work with a greater speed. Nor are the uses of the forge in the manufacture of large articles much more striking than the performances of the rolling-mill in the same department. We have seen large plates, containing as much as thirty-eight square feet of area, engine-beams weighing $11\frac{1}{2}$ cwt. when finished, and 13 cwt. in the slab, respectively formed in the rollers, from a single piece of iron previously prepared beneath the forge-hammer. (C. C. C. C.)

IRONY, in *Rhetoric*, is when a person speaks contrary to his thoughts, in order to add force to his discourse; for which reason Quintilian calls it *diversiloquium*. Thus, when a notorious villain is scornfully complimented with the title of a very honest and excellent person, the character of the person commended, the air of contempt that appears in the speaker, and the exorbitancy of the commendations, sufficiently discover the dissimulation of irony.

Ironical exhortation is a very agreeable kind of trope; which, after having set the inconveniences of a thing in the clearest light, concludes with a feigned encouragement to pursue it. Such is that of Horace, when, having beautifully described the noise and tumults of Rome, he adds ironically,

> Go now, and study tuneful verse at Rome.

IROQUOIS, the name given by the French to the confederacy of North American Indians, called by the English the *five*, and afterwards the *six* nations. They occupied an extensive tract of country near Lake Ontario, and make a considerable figure in the early history of British America. They are now very greatly reduced. Some of the tribes are extinct; others have made considerable advances in civilization; and others, again, have fallen into a state of squalid misery.

IRRADIATION, the act of emitting subtle effluvia, like the rays of the sun, in every direction.

IRREGULAR, something that deviates from the common forms or rules. Thus we say, an irregular fortification, an irregular building, an irregular figure, and the like.

IRREGULAR, in *Grammar*, such inflections of words as vary from the general rules. Thus we say, irregular nouns, irregular verbs, and the like. The distinction of irregular nouns, according to Mr Ruddiman, is into three kinds, viz. variable, defective, and abundant; and that of irregular verbs into anomalous, defective, and abundant.

IRRIGATION.

A HASTY inspection of irrigation and draining would lead to the belief that they are founded on opposite principles. It is seen that draining deprives the land of water, and that irrigation, on the contrary, supplies it with water. It is obvious that the great object of draining, and particularly of furrow-draining, is to present surface water which descends through the upper soil to the retentive substrata below it, with frequent opportunities of egress; and it is also obvious, that the great object of irrigation is to supply the upper soil, the firm foundation on which plants rear their superstructures, as much of surface-water as it can retain, for the purpose of promoting increased vegetation. Notwithstanding this apparent difference in principle between them, both induce similar effects, but the origin of which, lying deeper than the surface of the ground, might easily escape the notice of superficial observers. Both operations, in the first place, are meant to prevent all *stagnation* of water in the upper and under soils; both in fact create *currents* of water in the soil; and these circumstances are of themselves quite adequate to explain the effects of draining and irrigation on the same principle, and for the same purpose,—the promotion of vegetation. It has been found that all plants usually cultivated in agriculture cannot survive in stagnant water, and that in it their places are taken by others of a coarse nature. Now, aqueous meteors are generated in the atmosphere, and afterwards fall on the ground, and reach plants by the absorption of the soil in large quantities, and would stagnate there, were draining not to draw off the superfluous water unnecessary to vegetation in sensible currents, and prevent its stagnation. In like manner, although irrigation presents a copious flow of water to the soil; yet it provides the means of drawing off the redundancy in sensible currents, and preventing stagnation. As draining has the effect of rendering retentive subsoils porous, so irrigation is practised with most effect on porous soils. In short, so dependent are irrigation and draining on each other, that the former acts most beneficially only in conjunction with the latter. Thus the principle which is common to draining and irrigation is the prevention of the stagnation of water; and although of a negative character, it affords sure outlets to the superabundant moisture, and directly promotes vegetation.

The principle on which land is irrigated being thus explained, let us see how it may be made to operate practically, how land is really irrigated. There are four ways of irrigating land with water; and in order to preserve a command over its motions, it must in all cases enter the land to be irrigated at a higher level than where it leaves it.

This disposition of materials is the only way to make water move in a sensible and equable current. 1*st*, One kind of irrigation is called Bed-work Irrigation, which is the most efficient kind by which currents of water can be applied to level ground. 2*d*, Another kind is called Catch-work Irrigation, which is suited to uneven ground. 3*d*, A third gets the name of Subterraneous Irrigation, from the water being supplied upwards to the surface through drains in the subsoil. 4*th*, And the fourth kind is called Warping, when the water is allowed to stand over a level field till it has deposited the mud it contains.

Several particulars require deliberate consideration before determining on forming any kind of water-meadow. The vicinity of a river is a requisite particular, not so much on account of the supply of water, for that may be obtained in winter beside a mountain torrent or a lake, but on account of the fertilizing matter which is generally suspended in the waters of a river. Hence a river, flowing through an alluvial and cultivated country, is preferable to one through a mountainous and rocky country. An ample supply of water is absolutely necessary to beneficial irrigation. It is folly to incur the expense of forming the most perfect water-meadow without an ample supply of water to fill the channels to overflowing. The supply of the water must be on a higher level than the ground to be irrigated. The fall need not be more than is necessary for a pretty rapid current of water, which in ordinary cases may be ten inches or a foot for one hundred or two hundred yards, and about two feet for three hundred yards. The water, if possible, should be taken as far above the meadows as to have a sufficient fall without damming up the river. When this plan is impracticable, but only when impracticable, a dam should be thrown across the stream at such a distance above the meadow, as to secure not only a sufficient fall, but the fields on both sides of the river from inundation, whether the fields belong to different proprietors or not. For, in regard to dams across small streams which form the boundaries of farms or estates, it may not be irrelevant to mention that altercations have frequently arisen from supposed damages arising from inundations or infringements on the rights of waters. In every case, therefore, of constructing a dam for irrigation, it will be wise to avoid the chance of disputes, by acquiring, in the first place, the right for such an erection by purchase or otherwise. When a dam is inevitable, it should be constructed substantially. The first cost will be less than the repairing of a dam which has blown up from under or burst out at the sides. When water cannot be obtained under these pre-requisites, conjoined to an ample supply, then the formation of water-meadows at that place should be altogether relinquished. But should the requisite desiderata be available, the field to be converted into a water meadow should in the first place be thoroughly drained. The most perfect piece of workmanship as a water-meadow will be comparatively useless, unless the water which has passed through the soil to the subsoil find a free egress by drains. Without drains the water will inevitably stagnate on the subsoil, unless indeed the subsoil consists of very porous materials, such as sand, gravel, or fissured rock.

Besides the particulars enumerated, two essential rules in the formation of water-meadows should never be neglected, namely, that no part of them, however small, should be on a dead level; and that every drop of water, while irrigating, should be kept constantly in motion. These rules are founded on the very principle of irrigation which has been illustrated in the prefatory remarks. True inclined planes can be the only form of surface to which these rules will strictly apply; but although it may not be possible to stretch such planes along a great extent of surface, as ground is proverbially uneven, yet every portion of it which is watered directly from the main supply should be so exactly inclined. The spirit-level should be the *vade-mecum* of the irrigator, the eye being deceptive in regard to the levelness of ground; and even with that indispensable instrument, the irrigator will find the formation of a complete water-meadow on an irregular surface no easy task. Superficial observers may see little difficulty in the operation; but the practical irrigator knows how nice a thing it is to adjust irregularities of ground to the constant and equable flow of water. So great is this difficulty, that none but professional irrigators ought to attempt the formation of water-meadows, and they ought to be of established character and experience; for, as Arthur Young wisely remarks, "I should recommend, in the first instance, the employment of a professed irrigator, could the young farmer possess knowledge enough to ascertain the skill of such a man; but I have seen such gross blunders made in Norfolk by such a one, on the farms of four or five persons, and yet highly recommended and coming from Gloucestershire, that I really think a man may just as well trust to himself, with the assistance of books, as put any faith in men who are reputed skilful only in proportion to the ignorance of those who employ them. In the cases to which I allude, the ignorance was unpardonable; for, as they discovered that he drew out all his works without the assistance of a spirit level, they ought to have dismissed him. Not that such a man cannot make improvements, no one can well contrive to bring water on land without improving it; but to pay L. 4 or L. 5, or perhaps more, per acre, for using a small quantity of water to *some* advantage, when the same might be used elsewhere to the *greatest*, is, comparatively speaking, throwing away money."[1]

The first thing to be done for any water meadow is to make the conductor or drain which brings the water from the river to the meadow. The size of the conductor depends entirely on the quantity of water which the meadow requires. Its bottom, at its junction with the river, should always be as low as the bottom of the river, in order to carry away as much mud as possible to the meadows. Its course should be as straight and as near an inclined plane as possible. The stuff taken out of the conductor should be employed in equalizing its banks, or filling up irregularities in the meadow. These general directions naturally lead to the examination of the particulars of which the different kinds of water meadows enumerated consist.

I. BED-WORK IRRIGATION.

This species of irrigation is eminently applicable to level ground, and under it, as the name implies, the ground is thrown into *beds* or *ridges*. After the conductor has been brought from the river to the meadow as directed, it should be led along the highest end or side of the meadow in an inclined plane; and should it terminate in the meadow, and not have to proceed farther on to another, its end should be made to taper when there are no feeders, or to terminate in a feeder. The tapered end will retard the motion of the water, and containing, of course, less water, the water will overflow the banks of the conductor. The main drain to carry off the water after it has irrigated the meadow should next be formed. It should be cut in the lowest part of the ground at the lower end or side of the meadow. Its dimensions should be capable of carrying off the whole water used, so quickly as to prevent the least stagnation, and discharge it into the river. The stuff taken out of it should be used to fill up irregularities in the meadow. In case the river takes a turn along the lower end or side of the meadow, the turn should be used as a main drain to carry off the water, and save the expense of cutting a drain It

[1] *Farmer's Calendar*, p. 295.

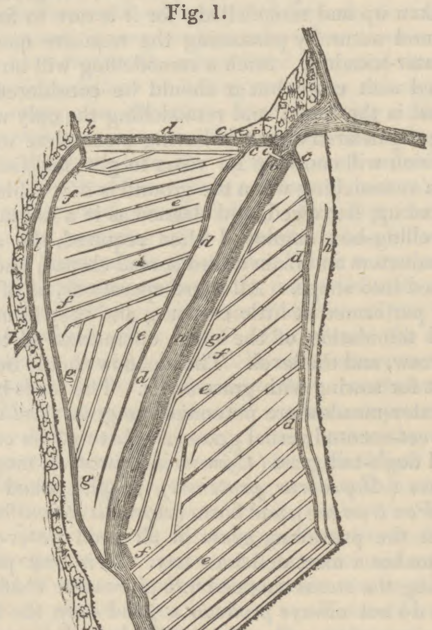
 may be imagined that as a portion of the water will be absorbed by the soil, the main drain need not be made so large as the conductor, merely to carry off the water that has been used; but in practice it will be found, that when the water is muddy, but little of it comparatively will enter the ground, because the sediment, acting as an impervious covering, prevents much of the water from descending into the ground. The next process is the forming of the ground intended for a water-meadow into beds or ridges. That portion of the ground which is to be watered by one conductor should be made into beds to suit the circumstances of that conductor; that is, instead of reducing all the beds over the meadow to one common level, they should be formed to suit the different swells in the ground, and should any of these swells be considerable, it will be necessary to give each side of them its respective conductor. The beds should run at or nearly at right angles to the line of the conductor. The breadth of the beds is regulated by the nature of the soil and the supply of water. Tenacious soils and subsoils, and a small supply of water, require as narrow beds as thirty feet. Porous soils and a large supply of water may have beds of forty feet. The length of the beds is regulated by the supply of water and the fall from the conductor to the main drain. If the beds fall only in one direction longitudinally, their crowns should be made in the middle; but should they fall laterally as well as longitudinally, as is usually the case, then the crowns should be made towards the upper sides, more or less according to the lateral slope of the ground. The crowns should rise a foot above the adjoining furrows. The beds thus formed should slope in an inclined plane from the conductor to the main drain, that the water may flow equably over them. The beds are watered by what are called *feeders*, that is, by channels gradually tapering to the lower extremities, and cut down their crowns, wherever these are placed. The depth of the feeders depends on their width, and the width on their length. A bed two hundred yards in length requires a feeder of twenty inches in width at its junction with the conductor, and it should taper gradually to the extremity, which should be one foot in width. The taper retards the motion of the water, which constantly decreases by overflow as it proceeds, whilst it continues to fill the feeder to the brim. The stuff which comes out of the feeders should be carefully and evenly laid along the sides of the beds. The water overflowing from the feeders down the sides of the beds is received into small drains formed in the furrows between the beds. These small drains discharge themselves into the main drain, and are in every respect the reverse of the feeders; that is, their tapering extremities lie up the slope, and their wide ends open into the main drain, to accelerate the motion of the departing water. The depth of the small drain at the junction is made about as deep as that of the main drain, and it gradually lessens towards the taper to six inches in tenacious and to less in porous soils. The depth of the feeders is the same in relation to the conductor. The stuff obtained from the small drains is employed to fill up inequalities in the meadow. For the more equal distribution of the water over the surface of the beds from the conductor and feeders, small masses, such as stones, solid portions of earth or turf fastened with pins, are placed in them, in order to retard the momentum which the water may have acquired. These *stops*, as they are termed, are generally placed at regular intervals, or rather they should be left where any inequality of the current is observed. Heaps of stones answer very well for stops in the conductor, particularly immediately below the points of junction with the feeders. Solid portions of earth are usually left in the feeders, or tough pieces of turf fastened down with wooden pins; but care must be taken to keep the tops of the pins below the reach of weeds floating on the surface of the water. These stops, however, are nothing but expedients to rectify work imperfectly executed. It must be obvious that a perfectly-formed water-meadow should require few or no stops. The small or main drains require no stops. The descent of the water in the feeders will no doubt necessarily increase in rapidity, but the inclination of the beds, and the tapering of the feeders, should be so adjusted as to counteract the increasing rapidity. At all events *notches* cut into the sides of the feeders to retard the velocity of the water, is much more objectionable than stops, although some writers recommend them; but where they have been observed, the spectator may depend on having seen an imperfect water-meadow. The distribution of the water over the whole-meadow is regulated by the sluice, which should be placed at the origin of every conductor. By means of these sluices any portion of the meadow that is desired can be watered, whilst the rest remains dry; and alternate watering must be adopted when there is a scarcity of water. Each sluice should be placed according to the elevation or depression of the ground which it supplies with water. All the sluices should be substantially built at first with stones and mortar; because a carelessly constructed sluice will permit the leakage of water at all times; and should the water from the leak be permitted to find its way into the meadow, that portion of it will stagnate and produce coarse grasses. In a well formed water-meadow it is as necessary to keep it perfectly dry at one time, as it is to place it under water at another. A small sluice placed in the side of the conductor opposite to the meadow, and at the upper end of it, will serve to drain away the leakage that may haply have escaped from the head sluice. The laying out of the beds, feeders, and small drains, constitutes the nice part of the formation of a water-meadow; it constitutes the test by which the skill of the irrigator is tried; and it is impossible to acquire the skill without practice.

To obtain a complete water-meadow, the ground should be broken up and remodelled; for it is rare to find a piece of ground naturally possessing the requisite qualifications of a water-meadow. Such a remodelling will no doubt be attended with cost; but it should be considered that the first cost is the least; and remodelling the only way of obtaining the desired object of having a complete water-meadow which will continue for years to give satisfaction. To effect a remodelling when the ground is in stubble, let it be ploughed up, harrowed, and cleaned as in a summer fallow; the levelling-box employed when required, the stuff from the conductors and main drains spread abroad, and the beds ploughed into shape. All these operations, as of the farm, can be performed at little expense, and they form the substantial foundation of the nicer operations of the spade, the barrow, and the level. The meadow should be ready by August for sowing with grass-seeds. The seeds best suited for a water-meadow are perennial rye-grass (*Lolium perenne*), sweet-scented vernal grass (*Anthoxanthum odoratum*), crested dog's-tail grass (*Cynosurus cristatus*), meadow foxtail grass (*Alopecurus pratensis*), rough-stalked meadow-grass (*Poa trivialis*), and fiorin (*Agrostis stolonifera*). The fiorin is the prevailing grass in all good water-meadows, and it makes a most delicious hay. It is best propagated by sowing the stems chopped into pieces like chaff. These grasses do not always produce a good crop the first year, but the rye-grass will assist to thicken the crop. Some writers, and particularly Mr Smith in his *Essay on Irrigation*, assert that it is of no importance what grasses are sown in water-meadows, as the most congenial kinds will in time spring up and banish all the others; but is it not better to supply the ground at once with the best grasses than wait for the extirpation of the worst? The method now described of forming a water-meadow is attended with one great disadvantage; the soft ground cannot be irrigated for two or three years after it is sown with grass-seeds.

This disadvantage can only be avoided where the ground is covered with old turf which will bear to be lifted. On ground in that state a water-meadow may be most perfectly formed. Let the turf be taken off with the spade, and laid carefully aside for relaying. Let the stript ground then be neatly formed with the spade and barrow, into beds varying in breadth and shape, according to the nature of the soil, and the dip of the ground; the feeders from the conductor, and the small drains to the main drain being formed at the same time. Then let the turf be laid down again and beaten firm, when the meadow will be complete at once, and ready for irrigation. This is the most beautiful and most expeditious method of making a complete water-meadow, and should always be adopted where practicable, although it should at first be the most expensive.

The water should be let on, and trial made of the work, whenever it is finished; and the motion of the water regulated by the introduction of a stop in the conductors and feeders, where a change in the motion of the current is observed, beginning at the upper end of the meadow. Should the work be finished as directed by August, a good crop of hay may be reaped in the succeeding summer. There are few pieces of land where the natural descent of the ground will not admit of the water being collected a second time, and applied to the irrigation of a second and lower meadow. In such a case the main drain of the watered-meadow may form the conductor of the one to be watered, or a new conductor may be formed by a prolongation of the main drain; but either expedient is only advisable where water is scarce. Where it is plentiful, it is better to supply the second meadow directly from the river, or by a continuation of the first main-conductor. In some instances it may be necessary to carry a conductor over a hollow piece of ground along an aqueduct made for the purpose, called a *carry-bridge*. Such an aqueduct may be made either of wood, cast-iron, or stone and mortar.

Fig. 1.



As a real example of a water-meadow, such as has been described, will illustrate the several particulars specified more accurately than any imaginative case, fig. 1 is a design of one belonging to Mr Loch of Rachan in Peebles-shire, and executed in 1823 by Mr George Stephens, drainer and irrigator, Edinburgh. The design is taken from Mr Stephens' *Practical Irrigator and Drainer*, 1834 (p. 10), a work of great practical utility. The meadow, as may be seen, in fig. 1, lies on both sides of the river Biggar, and contains eight acres, partly of clay, but mostly of gravel, and both resting on a gravelly subsoil. The river supplies the meadow amply with water. The expense of straightening the river, building the dam and sluices, and forming embankments against inundations in every flood, was L. 9 per acre. The work was executed late in spring 1823, and in 1825, four hundred stones of hay per acre were cropped, worth sixpence per stone, or L. 10 per acre, and L. 1 per acre for the aftermath, from land that was not worth L. 2 per acre before being irrigated. The references to the cut are these: *a* is the Biggar water; *b* is the dam 30 inches high across it; *cccc* sluices in conductors; *ddddd* conductors; *eeee* feeders; *ffff* small drains; *ggg* main drains; *h* a drain for cutting off natural springs; *i* a small sluice on the side of the conductor, to carry off any leakage of water from the sluice *c*; *k* a carry-bridge or aqueduct; *ll* conductor to another meadow; .... stops in conductors and feeders.

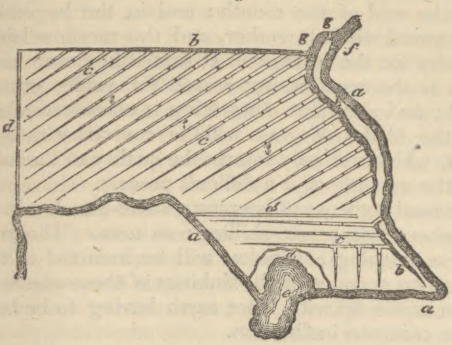
II. CATCH-WORK IRRIGATION.

This kind of irrigation is only applied to sloping banks, and should never be practised where the bed-work system can be introduced, although many are tempted, by the ease and economy of its construction, to prefer it. It is quite different in its construction from the bed-work. Were the feeders placed up and down the slope at right angles to the conductor, as in the case of bed-work irrigation, the water would acquire such a momentum in its descent, as to cut the ground into ruts. No number of stops could prevent this mischief. In order to prevent it, the feeders are cut across the face of the slope in parallel rows below each other. The water overflowing from the upper feeder is caught by the one below it, and so on in succession, till at last it finds its way into a main drain or the river. Main drains are less useful in this kind of irrigation than in the bed-work, as there are no small drains necessary to open into them, the tapering ends of the feeders discharging the water equally over the margin into the river. But it is obvious, that were the feeders on the lower level to receive their whole supply of water from those above them, the sediment in the water would be chiefly deposited by the upper feeders. It is therefore requisite to give a direct communication from the conductor to each feeder. To effect this, the direction of the feeders is made at an acute angle with the conductor, and their distance from each other is regulated by the fall of the ground, and the nature of the subsoil. Where the subsoil is porous, and the fall of the ground one foot in twenty or thirty, the distance between the feeders may be made from twenty to thirty yards; but where the declivity is less, and the subsoil tenacious, the distance should never exceed ten yards. Stops should be placed in the conductor immediately below the points of junction with the feeders; and in the feeders at regular distances, or rather where the current appears to accelerate its motion.

The expense of forming a catch-work meadow may vary from L. 3 to L. 5 per acre. The comparative cheapness of this kind of irrigation, induces many to adopt it in situations which ought to be occupied with bed-work irrigation.

The following design of a catch-work meadow, is taken from Mr Stephens' work above referred to. The meadow was formed by him in 1823, on the estate of Closeburn, in Dumfries-shire, belonging to Mr Stuart Menteith. The references to the cut are these: *aaa*, fig. 2, is the river; *bbb* are conductors; *ccc* feeders; *ddd* main drains, and the river also acts as a main drain; *e* is a lake; *f* the dam across the river; *gg* are sluices in the conductors; .... stops in the conductors and feeders.

Fig. 2.



It may frequently happen that the bed-work and catch-work systems may be beneficially united at the same fall of water. The conductor may be led along the higher ground, and give rise to a system of catch-work irrigation on the sloping ground, and terminate in the bed-work on the more level portion below. Such a compound structure may save much expense in levelling, and will make the most of the water. Instances of this compound-work may be seen at Whitehaugh in Peeblesshire, belonging to Sir John Hay, Bart., and at the Townfoot Meadow of Dolphinton in Lanarkshire, belonging to Mr Richard Mackenzie, writer to the Signet, Edinburgh.

MANAGEMENT OF WATER-MEADOWS.

The formation is not the only difficulty attending water-meadows; their good management is a nice business, and essential to the deriving of benefit from them. It must be confessed that much ignorance and negligence prevail in their management; and when the risk is considered of losing the whole of the fine herbage, and getting coarse in its stead, by bad mangement, a skilful irrigator is a character who ought to be highly appreciated. The particulars which require constant attention are, the state of the water in the river, whether there is sufficient to water the whole, or only a part of the meadow; the regulating of the sluices, so as not to permit more nor less water than the part of the meadow intended to be watered requires; the length of time the water should be allowed to remain on the meadow at different periods of the season; the proper time at which hay harvest and pasturage should commence and terminate; the state and nature of the soil to be irrigated, whether porous or impervious; and the removal of all minute obstructions to the perfect irrigation of the meadow.

Every size of river is not equally suitable for irrigation. A large flowing stream, supplying sufficient water at all times, affords facilities for irrigating a part or the whole of a meadow, much better than a brook which swells and falls with every shower of rain. At the same time whatever may be the command of water, it is an error to attempt to irrigate too large a surface at one time. The attempt to force a larger quantity of water than the feeders and drains can easily convey, will end in deluging one part, whilst another will be stinted; and where there is inequality of irrigation, there will be inequality in the quantity and quality of the grass. Where there is an ample supply of water, therefore, no more ground should be irrigated at one time than can be covered equally to the requisite depth by the natural force of the water. Where the supply is short of this, which is more frequently the case, the water should only have as much ground allotted to it as it can effectually irrigate. The intervals between the irrigations will be greater when the supply of water is scanty than when plentiful; but notwithstanding this, the effects produced on the meadow in both cases may be nearly equal, according as the weather is favourable or otherwise. The adjustment of the water by the sluices is a delicate operation under every circumstance, but particularly so when there is at times a deficiency of water. The falling or rising of the water in the river requires particular attention, and the changing of the water from one part of the meadow to another, or even from one bed to another, according to its abundance or deficiency, particular dexterity. Attention to the sluices for a short time every day, will obviate many risks of bad management. A great error may be committed by permitting the water to remain too long on the ground at a time. Unless the ground gets the air and becomes dry at stated periods, the finer grasses will be destroyed, and those of coarse quality will spring up. The watering may be continued for as long as fifteen days in the beginning of the irrigating season in November, but the time should be gradually lessened till March or April, when it should cease altogether. Between the intervals of watering, the land should be laid completely dry. Precautions are particularly necessary in letting the water off and on in frosty weather, frost taking quick hold of wet grass land, and throwing the plants out by the roots. The water should be let off on the morning of a dry day, and the land thus becoming dry in the course of the day, the frost will not injure the grass at night. Or, what is a still safer method, the water should be taken off in the morning and put on again at night, but few persons will take the trouble of attending so minutely to irrigation. In spring the new grown tender grass will be easily destroyed by frost, if the utmost attention be not paid to the state of the ground, either by protecting it with water, which is the surest protection it can receive, or making the ground thoroughly dry in dry weather, for dry cold never injures even young grass. There is another error which should be guarded against: when water remains too long on the ground in the spring, it generates a white scum, of the consistence of melted glue, which, when left on the grass, inevitably destroys it. Instances may be observed of water being permitted to remain on meadows from the autumn till eight or ten days before the cutting of hay. The consequences are, that the hay is of the coarsest quality, and the early bite for sheep entirely lost. It seems to be a judicious recommendation to depasture the early grass on water-meadows with ewes and lambs in March and April, and to eat it barely down before May with a heavy stock. After that the grass is allowed to stand for hay; but some recommend that it should be irrigated for a week, or a few days, to clean the pasture; whilst others think the irrigation unnecessary, and even dangerous, where sheep are kept, by tainting them with rot on the aftermath. There is no doubt that grass after being irrigated in summer, will affect sheep with rot; but whether that which has been irrigated in May, before the hay has been cut down, will so affect them on the aftermath, is not so decidedly known. At all events it is well known that the purest water allowed to irrigate land too long at any time, but particularly in spring or summer, deposites a substance which cannot be called a sediment, nor, judging by the eye, can it even be called an impurity. It is a very fine transparent colouring on the grass, nearly resembling the fine cobwebs which float through the air in a beautiful day in autumn. From its bad effects on sheep it was observed by our forefathers, and known to them by the name of *lace*. It may occasionally be observed on the sides of mountains near wells, having a sparkling appearance. This *lace* is a rapid promoter of rot in sheep.

When it is determined to irrigate, the drains and feeders should be previously inspected, all obstructions removed, and dilapidations amended. Whatever difference of opinion may exist on irrigating at this particular period of the season, all irrigators are agreed that early irrigation in autumn produces greater effects than late, and that water should be used largely during the winter, and scantily during the spring. It is possible that the benefits derived from early irrigation, especially after rains, may arise from the good effects of manure of various kinds, accumulated on the land during summer, being washed down by the rains, and mixed with the irrigating water; and it is certain that abundant irrigation in winter protects the grass from cold, as the temperature of grass under water in winter is seldom under 40° Fahrenheit. The signs of early and luxuriant vegetation observable on water-meadows in spring, when the rest of the ground may be covered with snow, evince the protective power of water. After the hay is carried off, the water is sometimes let on, to promote the growth of the aftermath, which it will no doubt do; but the rank grass encouraged by this summer irrigation will undoubtedly rot sheep. Where sheep are kept, and intended to depasture meadows, there should be no irrigation in summer. Cattle are not affected as sheep.

Should the irrigation be postponed till the autumn, in the beginning of October, the first duty of the irrigator is to see that all the feeders and drains are cleared of every obstruction, occasioned by the treading of sheep or cattle. The sluice is then drawn up, and if the water be abundant, the conductor and feeders will be filled with water in about half-an-hour. The motion of the water should first be adjusted in all the conductors; then in the feeders nearest the upper part of the meadow, and then in the lower ones in succession. The sluices regulate the water in the conductors, and the position of the stops regulates the water in the feeders. The stops should be so placed, as to cause the water to overflow the sides of the feeders, by making the openings at the sides of the stops wider or narrower. This first general inundation will shew any irregularities on the surface of the meadow; and that some irregularities will exist in the best-constructed water-meadows, it is not in the power of art to prevent. The earth in the filled-up hollows will subside, whilst the hard portions of ground which have been reduced will maintain their new shape. The irregularities should now be marked and rectified in the ensuing summer. At least three such adjustments of the water are necessary, before an irrigator should be satisfied that the meadow is properly irrigated with the requisite depth of one inch of water. This quantity of water should be continued over the meadow during October, November, December, and January, from fifteen to twenty days in succession, according as the weather is fresh or frosty, wet or dry. Between every such interval, the meadow should be laid thoroughly dry for five or six days, to give the grass air; and should the weather threaten a lengthened period of hard frost, the watering should be entirely discontinued for the time; for in thawing, the sheet of ice which covers the surface of the meadow will draw every plant of grass out by the roots, and make the soil like a mass of fermented dough. During the period of irrigation, the meadows should be regularly visited and inspected once in every three or four days, to correct any deviation from regular watering, such as may arise from collections of weeds, petty depredations of men and beasts, sticks, stones, or leaves, that may have fallen in and been detained in the conductors and feeders.

In February, great attention is required from the irrigator, as the grass will now begin to vegetate. The periods of watering must be shortened, and those of drying must be proportionally lengthened. White scum, frost, and such like evils, should be carefully avoided, as the tender grass will sensibly feel their injurious effects.

In March, the same precautions are requisite; but in the south of England, where grass is sufficiently abundant for stock in this month, the irrigation should be dispensed with. In Scotland, irrigation may be continued all April, but with such caution, that the water should be allowed to run only five or six days at a time, and gradually lessened towards the end of the month; and in the beginning of May dispensed with altogether, and the meadow laid thoroughly dry for the summer. It should be borne in mind, that this is the most trying season for young grasses in Scotland; and also, that if watering is continued after this month, the blades of grass will be covered with a gritty sediment, which not only injures the quality of the hay, but renders the mowing of it a difficult process.

The annual expense of keeping a water-meadow in repair may be about five or six shillings an acre. The greatest expense in keeping a meadow will be incurred in the second year, on account of the sinkings of those places which had been made up with loose earth having to be brought up to the common inclination.

III. SUBTERRANEOUS IRRIGATION.

This species of irrigation is so named, because the supply of water is derived from under the surface of the ground to the upper soil. It is only applicable to perfectly level ground, so raised above the supplying river, as to admit of a complete drainage of the field to be irrigated. This system of irrigation consists, in the first place, of ditches being formed around all the sides of the field. These act the part of conductors when the field is to be flooded, and of main drains when it is to be laid dry. The water flows from the ditches as conductors into built drains or conduits, formed at right-angles to them, in parallel lines through the fields, and it rises upwards in them as high as the surface of the ground, and again subsides through the soil and the conduits into the ditches as main drains, and thence into the river. Sluices are requisite to convey the water from the river into the ditches. This submersion, as it may be called, rather than overflow, of the ground in water, must be conducted with great care, and the water let on very calmly; for were the water let on or taken off with a forcible current, the finer particles of the soil would be detached, and carried off into the river. Indeed, however carefully the operation may be conducted, the only advantage derived from this species of irrigation is the moistening of dry ground in dry weather, which would otherwise be parched up; and in this respect the operation is best conducted in summer, and is as applicable to arable as to pasture land. It can therefore be of no importance to subterraneous irrigation, whether the water be clear or turbid, since all the sediment must be seethed through the soil, before it can possibly reach the surface of the ground.

IV. WARPING.

Warping is the overflowing of level ground with salt water within tide mark. Of course, it can only be practised near the sea, and most frequently it is attempted within the estuaries of large rivers, which have flowed through alluvial cultivated countries. Its immediate effect, which is highly beneficial, is the deposition of silt from the tide. To insure this deposition, it is necessary to surround the field to be warped with a strong embankment, in order to retain the water as the tide recedes. The water is admitted by valved sluices, which open as the tide flows into the field, and shut by the pressure of the confined water when the tide recedes. These sluices are placed on as low a level as possible, to permit the most turbid water at the bottom of the tide to pass through a channel in the base of the embankment. The silt deposited after warping is exceedingly rich, and capable of carrying any species of crop. It may be admitted in so small a quantity as only to act as a manure to arable soil, or in such a large quantity as to form a new soil. This latter acquisition is the principal object of warping, and it excites astonishment to witness how soon a new soil may be formed. From June to September, a soil of three feet in depth may be formed under favourable circumstances. These circumstances are summer, and the very driest season and longest drought. In winter and in floods warping ceases to be beneficial. In ordinary circumstances, a soil from six to sixteen inches in depth may be obtained, and inequalities of three feet filled up. But every tide generally leaves only one-eighth of an inch of silt, and the field which has only one sluicc can only be warped every other tide. The silt, as deposited in each tide, does not mix into a uniform mass, but remains in distinct layers. The water should be made to run completely off, and the ditches should become dry, before the influx of the next tide, otherwise the silt will not incrust, and the tide not have the same effect. Warp soil is of surpassing fertility. The expense of forming canals, embankments, and sluices for warping land, is, on an average, about L. 10 an acre. A sluice of six feet in height, and eight feet wide, will warp from sixty to eighty acres, according to the distance of the field from the river. The embankments may be from three to seven feet in height, as the field may stand in regard to the level of the highest tides.

V. FLOODING.

Flooding land on the margins of lakes may be considered as a specics of irrigation or warping. A successful attempt of this kind may be seen on the margin of Loch Ken, in Kirkcudbright, where 240 acres can be flooded at pleasure, when the water of the lake is in a favourable state.

In Great Britain, irrigation is practised to the greatest extent in Gloucestershire, Wiltshire, and Drumfriesshire, and partially in some other counties. In England it has long been successfully practised. Into Scotland it is comparatively of recent introduction. The estates of the Duke of Buccleuch on the Esk, Ewes, Yarrow, and Ettrick rivers, first enjoyed the benefits of irrigation to any extent in Scotland; but it is painful to observe that those water-meadows have fallen into decay from inattention. The land is now in a worse condition than if it had never been irrigated, because the very means which were used to direct the water to the land for beneficial irrigation, now form receptacles in which surface-water stagnates. Many of these meadows have since been broken up for corn culture, the high pricc of corn during the war having tempted their destruction. Now that live-stock remunerates the farmer better than corn, the rash step of destroying them has no doubt been by this time sincerely repented of. The water-meadows belonging to Mr Menteith of Closeburn, in Dumfriesshire, were formed about the same time, but having, since their formation, been carefully attended to, they continue to yield abundantly.

Warping is only practised in Lincolnshire and Yorkshire, in the estuary of the Humber, in the rivers Trent, Ouse, and Dun, which flow into it. The silt is an extraordinary substance. It seems to be doubted whence it comes. The Humber is clear at its mouth, and none of the rivers which flow into it bring the silt down in the floods. On the contrary, the floods invariably injure its quality, which is in the highest perfcction in the driest summers. Apparently it is a mixture of sand and clay, for it cakes on drying, and will cleanse cloth of grease like fuller's earth; and its arenaceous property is quite obvious; but its analysis by a chemist many years ago afforded no clay, the principal ingredients being a fine sand, a considerable portion of lime, some mica, and a minute portion of saline matter. It would be desirable to have a correct analysis, by some eminent chemist of the present day, of this remarkable substance.

Subterraneous irrigation is chiefly practised in drained morasses, which are apt to become too dry in summer, by closing up the mouths of the main drains, and causing the water in them to stand back in all the drains till it rises up to the soil. It was recommended by the late celebrated engineer Mr Rennie, to be practised on some extensive fens which he had drained in Lincolnshire, near Boston. To irrigate effectually in this manner, it is necessary to build the mouths of the main drains with strong masonry, and erect sluices for the retention of the water in the drains. This species of irrigation may also be attempted on any flat piece of ground resting on a gravelly bottom, by means of ditches which surround it, and which can command water from a lake or river. Turnips or potatoes, or any kind of crop, whether drilled or not, might be beneficially watered in this manner in a dry summer.

ADVANTAGES OF WATER-MEADOWS AND WARPING.

The advantages derived from water-meadows and warping, as stated by authors who have written on those subjects, almost exceed credibility. One author of some standing says:—"Having heard that the proprietor of an old floated meadow at South Cerney (in Gloucestershire), had disposed of the produce of it, in the year 1795, in a way well calculated to ascertain its real value, I wrote to a person who resides on the spot, requesting him to send me a particular account of the product, and I received the following statement.—In ordcr to make the most of the spring feed, the proprietor kept the grass untouched *till the 2d day of April*, from which time he let it to the neighbouring farmers, *to be eaten off in five weeks* (*which ran a week into May*), by the undermentioned stock, at the following rates per head, viz. a sheep tenpence per week; a cow three shillings and sixpence; a colt four shillings. The quantity of land is eight acres.

107 wether sheep one week, . .	L. 4	9	2
8 cows do.	1	8	0
4 colts do.	0	16	0
	L. 6	13	2
Which for five weeks amount to .	L. 33	5	10
Add three colts for three weeks, . .	1	16	0
Equal to L. 4 : 7 : 8 per acre,	L. 35	1	10
The hay crop was, as usual, about fifteen tons, and was five weeks in growing.			
15 tons, suppose at 50s. per ton, . .	37	10	0
Afternıath, 15s. per acre, . . .	6	0	0
Total, equal to L. 9 : 16 : 5 per acre,[1]	L. 78	11	10

The L. 4 : 7 : 8 were made at a time when other grass-lands are in a dormant state, or exhibit but feeble symptoms of vegetation. But the reader will perhaps see the advantages of this art in a still stronger light, when he is told that this meadow, which is now in the occupation of a miller, was a few years ago in the hands of a farmer, who, being at variance with the miller, was entirely deprived of the use of the water for a whole winter, which, unfortunately, was succeeded by a very dry spring and summer; of course the spring feed was lost; and the whole hay crop of eight acres was only three tons."[1]

In 1802, Mr Smith laid out a water-meadow on the Pais-

[1] Wright *on Irrigation*.

Irrigation. ley farm, near Woburn, Bedfordshire, for the Duke of Bedford, and in 1803 its produce was as follows:—

In March, 240 sheep for three weeks, at 6d. each per week, ...	L.18 0 0
In June, mowed 18 tons hay, at L.4 per ton,	72 0 0
In August, mowed 13½ do. do.	54 0 0
In September, eighty fat sheep for three weeks, at 4d. each per week, . . .	4 0 0
It then fed lean bullocks, the feeding not valued, equal to L.16 : 13 : 8 per acre,[1]	L.148 0 0

These two cases may suffice as examples of successful irrigation in England. The following cases occur in Scotland, a country, from its irregularity of surface, not naturally suited to that species of improvement. Nevertheless, in all the pastoral districts, both in the north and south, an abundance of early food in spring for ewes and lambs might be obtained, by judicious irrigation, in every valley which contains a river. In mountainous districts, the rivers may not supply the richest quality of water for irrigation, but there the soil on the margins of rivers being generally of friable loam, would be peculiarly benefited by irrigation. Such land is invariably sound for sheep when drained; and if made dry, and then irrigated, it would, early in spring, and indeed throughout the summer, afford the finest quality of the richest herbage. Water-meadows in such situations could be inclosed by themselves, and they could supply hay, if required, for the sheep-stock in winter, or be pastured at pleasure by any kind of stock during the summer.

To begin with an instance of simple irrigation in a pastoral district. "Fallaw Meadow, on a large sheep-farm belonging to Sir George Montgomery, Bart. of Macbiehill, in Peeblesshire, containing fifteen acres, was inclosed from moorland in 1816; and by collecting the water from the surrounding sheep-drains, five acres are partially irrigated, and the remaining ten are top-dressed with the manure made from part of the produce which is consumed in winter by the sheep of the farm, in a wooden shed near the meadow. By this simple method of improvement, fifteen acres of common sheep-pasture land give the proprietor from three thousand five hundred to four thousand stones of hay per annum, averaging sixpence per stone. What an immense advantage to a sheep-farm! By this simple process of inclosing, and cutting a few small feeders and drains, the owner is enabled to provide food for his flock, when his less fortunate neighbours' sheep must either starve or be supplied from the farm-yard; but I am afraid there are very few sheep-farmers who are so fortunate as to have any hay beyond what is requisite for stock at home. Sir George fed the same number of sheep on the farm as he did before the meadow was taken off and inclosed; and I am fully persuaded that the same improvement might be made on almost every sheep-farm in Tweeddale, for in almost all of them, there are situations where fourteen or fifteen acres might be inclosed and partially irrigated, as in every pastoral district there are numerous rills which might be easily collected and used to the greatest advantage, at a very trifling expense; so that, instead of being obliged, in snow-storms, to send fifty thousand sheep to a milder climate in the southern parts of Dumfriesshire (where owners are obliged to be at the mercy of their southern neighbours, not to mention the very serious injury the flocks receive by long and fatiguing journeys), by adopting the above system of improvement a considerable part of the losses generally sustained every year would be prevented."[2]

Here is an instance of the conversion of peat-bog of little value into a water-meadow of great value. "Sir Thomas Gibson Carmichael, Bart. of Castle Craig, commenced, Irrigation. in the year 1817, by forming five acres with the plough and spade into regular bed-work. The land, in its natural state, was a complete bog, valued at eight shillings of yearly rent per acre. The formation was difficult, on account of the great number of deep peat-holes which were obliged to be filled up, to bring the surface to a proper level. The expense of levelling and forming the beds was L.6 per acre, the crop of hay was 466 stones of 22 lb. per stone per acre, valued at fivepence per stone, and the after-grass at 18s. per acre, making L.10 : 12 : 2 per acre of gross produce."[3]

But the greatest promoter of irrigation in Scotland is Mr Stuart Menteith of Closeburn, in Dumfriesshire. His water-meadows comprehend both mossy and good soil. They extend to about two hundred acres, and are connected with reservoirs for containing water which can flood two hundred acres more. In his estate in Ayrshire, on the river Nith, Mr Menteith intends to form two hundred acres more of water-meadows. As a proof of the possibility of improving good land by irrigation, the catch-work meadow, represented by fig. 2, containing twenty-five acres, is a remarkable and satisfactory instance of Mr Menteith's operations. "The land of this meadow, before being watered, was worth L 3, 10s. per acre, the expense of levelling and formation L.5 per acre. The produce of 1824 was as follows:—

200 ewes and lambs for seven weeks, at 5d. each per week, ...	L.29 3 4
300 stones of hay per acre, at 8d. per stone,	250 0 0
Aftermath, at 20s. per acre, ...	25 0 0
	L.304 3 4

Being L.12 : 3 : 4 per acre. The quality of the hay was equal to that of any clover-hay in the kingdom."[4]

Another instance only, among many which exist in Scotland, shall be given of the advantages derived from common irrigation, and that is, of the bed-work water-meadow belonging to Mr Loch of Rachan, in Peeblesshire, and forming the subject of the first figure illustrating this paper. "It was formed late in the spring of 1823; the crop of hay in 1825 was judged by the neighbours to be upwards of 400 stones per acre, worth sixpence per stone, and the aftermath at L.1 per acre, making the gross produce worth L.11 per acre, instead of L.2, at which the land was valued before being irrigated."[5]

But this enumeration of the several cases of successful irrigation would be incomplete, were the water-meadows in the neighbourhood of Edinburgh omitted to be particularized. The city of Edinburgh stands on an eminence, which commands the cultivated country around it. Commanding as the situation is, water from the Crawley Spring, in the Pentland Hills, situate at seven miles distance, flows to the top of every house in the city. A ready means is thus provided of washing away all the filth of the houses and streets, which is conveyed in large sewers to the lower end of the town, where their contents are made to irrigate many acres of naturally rich and also of poor soil. Probably upwards of 200 acres are thus irrigated for the production of grass for the cowfeeders who supply milk to the inhabitants. The rent for which these meadows are let in small portions to cowfeeders varies on an average from L.20 to L.30 per acre. Some of the richest meadows were let in 1835 at L.38 per acre; and in that season of scarce forage, 1826, L.57 an acre were obtained for the same meadows. The largest proprietor of these meadows is Mr Miller of Craigintinny, who possesses about one hundred and thirty acres; part of them, comprising land

[1] Smith's *Essay on Irrigation.* [2] Stephens' *Practical Irrigator.* [3] *Ibid.* [4] *Ibid.* [5] *Ibid.*

now of the richest quality, having been thus watered for nearly a century, and part of them of the poorest sandy soil. The waste land called the Figget Whins, containing thirty acres, and ten acres of poor sandy soil adjoining them, were formed into water-meadows in 1821, at an expense of L.1000. The pasture of the Figget Whins used to be let for L.40 a-year, and that of the ten acres at L.60. Now the same ground, as meadows, lets for L.15 or L.20 an acre a-year, and will probably let for more as the land becomes more and more enriched. It is stated by Mr Stephens,[1] that one hundred and ten acres of Mr Miller's meadows, in 1827, yielded a clear profit of L.2300. The repair of these meadows costs from ten to fifteen shillings per acre, which is comparatively a large sum for repairs, but then they are not only watered during the winter, but for two or three days between the intervals of cutting the grass during the summer. The grass is cut from April to November, every three, four, or five weeks, according to the richness of the vegetation. It is exceedingly tender and succulent, and suitable to the production of a large quantity of milk; and were it not frequently cut, it would lie down, and soon rot at the roots.

After these striking instances of the advantages which are derivable from irrigation in a pecuniary point of view, by largely increasing the rent of land, must be mentioned the advantages which are derived from a large increase in the produce of the soil. The early grass in March, which could only be fostered by irrigation, is of the most essential use to ewes and lambs, and it offers an excellent substitute for the artificial grasses, which are usually obliged to be heavily stocked in early spring, when they are unable to bear it; and in truly pastoral districts, where artificial grasses are cultivated to a limited extent, and where old grass is generally long in springing, the breeding stock of sheep is apt to suffer in spring; but an irrigated meadow would not only supply early and abundant food, but it would enable the store-masters to raise an early crop of lambs. The large crop of fine hay which is subsequently cut from water-meadows after the pasturage of the early grass, also insures the safety of the flock, and the growing condition of the herd, in the severest winter; whilst it at the same time supplies the manure which fertilizes, to an increasing extent, the land kept under arable culture. Whether, therefore, in pastoral districts, or in the neighbourhood of large towns, or wherever an abundant supply of river water through an alluvial cultivated country can be obtained, irrigation will certainly repay, in a short time, all the expense and trouble which are necessary for its preparation.

The advantages of warping are thus described, in a particular instance, by Arthur Young:[2] "Mr Webster, Bankside, has made so great an improvement by warping, that it merits particular attention. His farm of 212 acres is all warped, and to show the immense importance of the improvement, it would be necessary only to mention that he gave L.11 an acre for the land, and would not now (1805) take L.70 an acre; but he thinks it worth L.80, and some even L.100; not that it would sell so high at present; yet his whole expenses of sluices, cuts, banks, &c. did not exceed L.2500, or L.12 an acre. Take it at L.12, and add L.11, the purchase money, together L.23 an acre; if he can sell it at L.70, it is L.47 per acre profit. This is prodigious, and sufficient to prove that warping exceeds all other improvements. He began only four years ago. He has warped to various depths eighteen inches, two feet, two and a half feet, &c. He has some, that before warping was moorland, worth only one shilling and sixpence per acre, now as good as the best. Some of it would let at L.5 for flax or potatoes, and the whole at fifty shillings. He has twenty acres that he warped three feet deep between the beginning of June and the end of September, and eighteen acres, part of which is three feet and a half deep. He has applied it on stubbles by way of manuring, for it should be noted, as a vast advantage in this species of improvement, that it is renewable at any time; were it possible to wear out by cropping or ill management, a few tides will at any time restore it. As to the crops he has had, they have been very great indeed; of potatoes from 80 to 130 tubs of 36 gallons, selling, the round sorts, at three shillings to three shillings and sixpence a tub, and kidneys at five to eight shillings. Twenty acres warped in 1794, could not be ploughed for oats in 1795, he therefore sowed the oats on the fresh warp, and scuffled in the seed by men drawing a scuffler, eight to draw and one to hold; the whole crop was very great, but on three acres of it, measured separately, they amounted to fourteen quarters one sack per acre. I little thought of finding exactly the husbandry of the Nile in England. I had before heard of clover-seed being sown in this manner on fresh warp, and succeeding greatly. He warped twelve acres of wheat stubble, and sowed oats in April, which produced twelve quarters an acre. Then wheat thirty-six bushels an acre. His wheat is never less than thirty. Six acres of beans produced thirty loads per acre, or ninety bushels; one acre, measured to decide a wager, yielded ninety-nine bushels; has had 144 pods from one bean on four stalks; and Tartarian oats seven feet high. One piece warped in 1793, produced oats in 1794, six quarters an acre; white clover and hay-seeds were sown with them, mown twice the first year; the first cutting yielded three tons of hay an acre; the second one ton, and afterwards an immense eddish. Flax forty to fifty stones per acre. Warping, it seems, brings weeds never before seen, particularly mustard, and cresses, wild celery, with plenty of docks and thistles."

It is seen, from this statement of Mr Young, that the advantages of warping are very great; and surely so important an improvement ought not to be neglected when it can be put into practice. It is much superior in its effects to irrigation with common water, the mud creating a new soil, and not merely amending an old one. What the land intended to be warped may be, is not of the smallest consequence; a bog, clay, sand, peat, is all one, as the warp raises a soil in one summer of six to eighteen inches thick, and fills up every inequality.

Warped land at first being raw and cold, requires particular treatment. Corn is not the best crop after warping. Oats, it has been seen, may succeed, barley is never attempted, and wheat is not advisable, but sown grass-seeds thrive most luxuriantly. It is good husbandry, therefore, to sow warp with grass-seeds, and let them remain for at least two years; after them wheat will succeed, then beans, and then wheat again, but never barley on any consideration. All the green crops succeed well. In some instances, warp may contain as much salt as to hurt vegetation, in which case an exposure to the air in summer is necessary to neutralize its pernicious action on vegetation.

The quality of the water is an important element in the process of irrigation. It has been alleged that whether water is clear or turbid, irrigation is of service to grass land. There is much truth in this allegation; but it does not declare the whole truth. No doubt moisture alone is of great service to the vegetation of grass on sandy soils in a dry season; but a deposition of mud along with the moisture would surely not benefit the grass the less, nor would it injure the bare soil.

The waters of the Nile and Ganges would alone promote vegetation on their banks, the soils of which seldom expe-

[1] Stephens' *Practical Irrigator*, p. 77.

[2] *Farmer's Calendar*, p. 387.

rience the refreshing sustenance of rain; but the inundations of those mighty rivers would not be hailed with ecstasy and gratitude on the return of every season, were their waters devoid of the fertilizing mud with which they are largely impregnated. Major Rennell states that the Ganges contains a two-hundredth part of its volume of mud, and that it thus carries 2,509,056,000 cubic feet of it per hour. In like manner, the Nile contains a hundred and twentieth part of its bulk in mud, or 14,784,000 cubic feet of it per hour. It is impossible but that the water of all rivers contains at all times, even when purest, some sediment; but it is obvious that those rivers which flow through cultivated countries must contain at all times the greatest quantity of sediment. In this way the rivers of plains must contain more mud than the rivers of mountains; and hence irrigation exhibits the most favourable results in the plains. But were no other proof of the superiority of turbid over clear water for irrigation to be found, the luxuriant produce of the water-meadows in the neighbourhood of Edinburgh, which are watered from the common sewers of that city, would of itself supply a convincing illustration.

Similar results could *never* be derived from clear water; nor is *it ever* found so superabundantly rich as to be necessary to be treated like the water of those meadows next the town, where holes are dug in the ground, for the purpose of catching the grosser materials with which it is charged, before it is used for irrigation.

VI. HISTORY OF IRRIGATION.

Irrigation is at least coeval in antiquity with embanking and draining. It is probably of greater antiquity. Nature had, no doubt, first taught man the art of irrigation by the inundations of rivers; but nature could teach neither embanking nor draining. Egypt was the field which was first artificially irrigated. There the fertilizing effects of the water of the Nile, after its overflow, could not fail to attract the attention of its inhabitants, and teach a simple lesson to the Egyptians, who had only to imitate nature, to secure the fertility of the soil lying beyond the reach of the inundations of the Nile. The remains of canals as capacious as the beds of rivers, which are still to be seen in that sand-desolated country, evince the gigantic efforts which had at one time been made by its inhabitants to irrigate that portion of their country upon which a drop of rain never falls to refresh its languishing vegetation. These canals traverse the whole country, and are so directed as probably to have been made to receive the water of the Nile, and conduct it to every part, to the top of the rising grounds as well as to the bottom of the hollows; the inequalities of hill and dale not being great in Egypt. The large lakes of Mœris, Behire, and Mareotis, all probably artificial excavations, had perhaps once formed extensive reservoirs to supply the canals, after the Nile had retired within its own banks. At what time all these mighty contrivances were begun, history is as silent as on the origin of the pyramids. It is, however, related that Sesostris greatly increased the number of the canals, which must have been at a period of great antiquity, for he reigned about the sixteenth century before the Christian era. Greater efforts to promote irrigation were more urgent in Egypt than in most other countries; for no rain fell in that country to cherish vegetation; and rice forming the chief food of its inhabitants, it could not be raised without a great supply of water.

It is therefore highly probable that the remains of great canals and lakes are indicative of the majestic scale with which the Egyptians had prosecuted the art of irrigation. It is, however, prudent to speak with caution on matters connected with the agriculture of ancient Egypt; for our knowledge of its husbandry is chiefly derived from hints contained in Scripture history, and not from its own historical records. The historian of Egypt, Herodotus, was a Greek, and lived at so late a period as the fifth century before the Christian era, long after the glory of Egypt had departed; whereas the Scriptures supply us with facts of Egyptian agriculture of much greater antiquity, isolated though they certainly are. Such circumstances as the following indicate the existence of irrigation in Egypt at a very remote period of the world. When Abraham and Lot journeyed together in search of a country to abide in after they had left Egypt, they agreed to separate, when they found that the land they were then in could not supply sufficient food for their united flocks and herds; and we are told that Lot chose the plain of Jordan, because it was watered as well as the land of Egypt. "And Lot lifted up his eyes and beheld all the plain of Jordan as thou comest into Zoar, that it was well watered every where, before the Lord destroyed Sodom and Gomorrah, even as the garden of the Lord, like the land of Egypt."[1] Egypt never contained rivers to water it, there being only the Nile; so that the similitude between "the plain of Jordan" and "the land of Egypt," to the mind of Lot, must have arisen from the rivers in Jordan being as numerous as the canals in Egypt; and Lot having witnessed the fertilizing powers of the water of these canals in Egypt, naturally supposed that the rivers would produce a similar effect on the plain of Jordan. The Egyptians had been in the habit of watering their gardens as well as their fields, and this they accomplished at pleasure, by raising water with a machine which they worked with the foot. Simple as such contrivances were, and they are to be seen in Egypt at this day, they could not fail to be troublesome. Dr Clarke describes the Egyptians, when raising water for their gardens, as requiring to work stark naked, or only partially covered with a blue striped shirt. When Moses, therefore, described the promised land to the Israelites, he represented it as a land which was supplied with water in a natural manner, in contradistinction to the more difficult and artificial way by the foot in Egypt: "For the land whither thou goest to possess it, is not as the land of Egypt from whence thou camest out, where thou sowedst thy seed and wateredst it with thy foot, as a garden of herbs: But the land whither ye go to possess it, is a land of hills and valleys, and drinketh water of the rain of Heaven: And it shall come to pass, if ye shall hearken diligently unto my commandment which I command you this day, that I will give you the rain of your land in due season, the first rain and the latter rain, that thou mayest gather in thy corn, and thy wine, and thine oil."[2]

By irrigation, the soil of Egypt had been rendered so fertile that Pliny compares it to that of the Leontines, formerly the most fertile part of Sicily. Certain it is that Egypt was very prolific in corn even in the days of Abraham, who had recourse to it in years of famine, and that was at least eighteen centuries before the Christian era.

Too little is known of the agriculture of the ancient kingdoms of Assyria, Babylon, Carthage, Phœnicia, and Greece, to enable any one to ascertain how they practised irrigation; but as they all had Egypt as an example in agriculture and the arts, it is probable that they had followed those practices in husbandry which were most suitable to their respective countries. The little that Xenophon says in his *Anabasis* of the husbandry of Persia, would lead to the belief that canals had been cut from rivers to irrigate the country after the manner of Egypt.

The sagacious Romans, it is well known from the writings of their rustic countrymen, adopted irrigation on an extensive scale, as one of the best means of improving land. The

[1] Gen. xiii. 10.

[2] Deut. xi. 10, 11, 13, 14.

oldest Roman rustic writer, Cato, expressed his opinion that the way to become rich quickly was "by grazing cattle well," and hence he gives the preference to meadows. He does not maintain that grass is the most valuable crop which the land can produce, for he only places meadows in the fifth degree of value, giving preference in this respect to vineyards, watered gardens, willow fields, and olive gardens, but that they yielded most profit in proportion to the expense attending them, and they were always ready; hence their ancient name, *parata*. Agreeably to this opinion, Cato recommends the formation of meadows, and particularly of water-meadows, whenever there is a command of water: *Prata irrigua, si aquam habebis, potissimum facito.*[1] Columella recommends the same precept, and enters more minutely into the kinds of soils which should be converted into water-meadows, and of the nature of the surface best adapted to them, as well as the management of the water in the time of irrigation. "Land that is naturally rich," says he, "and that is in good heart, does not need to have water set over it; and it is better hay which nature of its own accord produces in a juicy soil, than what water draws from a soil that is overflowed. This, however, is a necessary practice when the poverty of the soil requires it; and a meadow may be formed either upon stiff or free soil, though poor, when water may be set over it. Neither a low field with hollows, nor a field broken with steep rising ground, are proper; the first, because it contains too long the water collected in the hollows; the last, because it makes the water run too quickly over it. A field, however, that has a moderate descent may be made a meadow, whether it is rich or so situated as to be watered; but the best situation is where the surface is smooth, and the descent so gentle as to prevent either showers or the rivers that overflow it from remaining long; and on the other hand, to allow the water that comes over it quietly to glide off. Therefore, if in any part of a field intended for a meadow, a pool of water should stand, it must be let off by drains, for the loss is equal, either from too much water or too little grass."[2] But none of the Roman rustic writers give directions *how* a *water*-meadow should be made, nor say any thing about the utility of sluices, although Columella gives minute directions about the formation of *dry* meadows. It does not appear, moreover, that they were acquainted with the raising of turf and laying it down again for meadows, because they only recommend hay-seeds from the hay-lofts and cribs to be sown, and deprecate the watering and pasturing of cattle on the new meadows till the surface becomes hard. There is no specific notice taken by any of them of how long a period meadows should be watered, if one sentence of Pliny be excepted, wherein he directs that "meadows ought to be watered immediately after the equinox, and the waters restrained whenever the grass shoots up into the stalk;"[3] but there is no hint whether they should be laid dry at intervals.

Pliny alone mentions watering before the first crop of hay is cut, on the principle that wet grass, whether wetted by water or dew, is cut more easily than dry: *Noctibus roscidis secari melius.*[4] The Romans were in the custom of cutting their meadows at least twice a-year, in May and August or September, and making hay of both these cuttings; but meadows for forage were cut sometimes four times. The autumnal hay was emphatically called *cordum*, and being soft, and sweeter than hay come to its full growth, it was the kind most proper to be given to sheep in winter. The produce of the Roman meadows appears to have been very considerable, and it is therefore no wonder that they put such a high value on grass-land. Both Columella and Pliny estimate it a day's work for a man to mow a *jugerum* and bind 1200 bundles of hay, of four pounds each. According to a calculation made by Dr Dickson, these quantities would give a produce of 265 hay stones, of 22 lb. to the stone, per acre (416 imperial stones per imperial acre), of prepared hay, besides the autumnal crop and the rakings taken up afterwards, and which may be estimated at one-half more.[5] This is not the proper place to describe the Roman method of making hay, which differed from the method of this country, but having alluded to hay having been bound in bundles, it may not be irrelevant to state that the Romans made up their hay into bundles of four pounds each before they carried it into the barns or haylofts, and that they never ricked it but in rainy weather.

Immediately after the fall of the Roman empire, agriculture declined, and was kept in a very depressed state during the middle ages, which depression, with respect to agriculture, lasted about ten centuries. It need therefore excite no surprise that the general agriculture of Italy was not much improved, from what it had been amongst the Romans, till after the revival of letters. Irrigation was perhaps the only branch of agriculture which received improvement or extension before the expiration of the dark ages; and its improvement at that time was even confined to the north of Italy. The irrigation of Lombardy to this day forms the principal feature of its agriculture. The Lombard kings, following the example of the Romans, encouraged and extended irrigation, and they were ably assisted by the inmates of their numerous and wealthy religious establishments.

Under these favourable auspices, irrigation had been extended on a great scale in Lombardy as early as 1037; and such expert hydraulic engineers had the monks of Chiarevalle become, that they were consulted and employed as such by the Emperor Frederick I. in the thirteenth century; and, ever since, so assiduous has been the care with which the agriculturists in Lombardy have preserved entire, and in good working order, their water-meadows, that at the present day no other part of the globe can exhibit that operation on so grand a scale and in such excellent order, and producing so rich a pasturage, verdant throughout the year. The largest rivers in the north of Italy, the Po, the Adige, the Tagliamento, and others, are put under requisition for a supply of water in summer and winter, for the purposes of irrigation; the whole country from Venice to Turin being almost one continued water-meadow. But there irrigation is not confined to grass-land; water being also conducted between the ridges of corn-land; in the hollows between drilled crops; among vines; and over the flats appropriated to the production of rice: and it is also used to deposite mud, in the manner of warping, where it contains sediment. Irrigation naturally passed from Lombardy into the south of France, where it is used to raise many of the more valuable productions of the soil. Spain to this day employs irrigation to so considerable an extent, that few crops are there raised without it. Some water-meadows in the neighbourhood of Salisbury, in Wiltshire, which are said to have existed from time immemorial, have led to the belief that irrigation has been practised in Britain from the time of the Romans. It is, indeed, extremely probable, that had the Romans constructed such works during their sojourn in Britain, the pastoral habits of their Saxon successors would have preserved them from destruction. But be this as it may, it is certain that irrigation after the method of Italy was not extensively introduced into Britain till the sixteenth century, when it was attempted on a large scale in Cambridgeshire, on the estate of Barbraham, by one Pallavicino, the collector of Peter's pence in the reign of Queen Mary, but who, on the accession of Elizabeth, had the art to turn Protestant, and

[1] Cat. cap. ix. [2] Col. lib. 2. cap. xvii. [3] *Nat. Hist.* lib. 18, cap. xxvii. [4] *Ib.* lib. 18, cap. xxviii.
[5] *Husbandry of the Ancients*, vol. ii. p. 321.

purchase that estate with the balance of money which he had in his possession, amounting it is said to L. 30,000 or L. 40,000, and appropriate it to his own use.[1] This dishonest experiment of Pallavicino was so gross, that his example as an irrigator was not followed at the time, nor indeed were many water-meadows formed in England till the end of the last or beginning of the present century. Since that time, many of them have been scientifically made both in England and in Scotland, which all have proved how profitably irrigation might be extended, and of which a few successful examples have been enumerated. As might be expected from the nature of the climates, irrigation is extensively practised in India, China, and parts of America, particularly Mexico; but as the irrigation of those countries presents no features peculiarly different from that related of Egypt and Italy, it is unnecessary to enlarge upon it.

VII. THEORY OF IRRIGATION.

The theory of irrigation, as propounded by the late Sir Humphrey Davy, is given by him in these words: "Water is absolutely essential to vegetation; and when land has been covered with water in the winter or in the beginning of spring, the moisture which has penetrated deep into the soil, and even the subsoil, becomes a sort of nourishment to the roots of the plants in the summer, and prevents those bad effects which often happen in lands in their natural state from a long continuance of dry weather. When the water used in irrigation has flowed over a calcareous country, it is generally found impregnated with carbonate of lime, and in this state it tends, in many instances, to ameliorate the soil. Common river water also generally contains a certain portion of organizable matter, which is much greater after rains than at other times, and which exists in the largest quantity when the stream rises in a cultivated country. Even in cases where the water used for flooding is pure, and free from animal and vegetable substances, it acts by causing the more equable diffusion of nutritive matter existing in the land; and in very cold seasons it preserves the tender roots and leaves of the grass from being affected by frost. . . . In general, those waters which breed the best fish are the best fitted for watering meadows; but most of the benefits of irrigation may be derived from any kind of water. It is, however, a general principle, that waters containing ferruginous impregnations, though possessed of fertilizing effects, when applied to a calcareous soil, are injurious on soils that do not effervesce with acids; and that calcareous waters, which are known by the earthy deposite they afford when boiled, are of most use on siliceous soils, or other soils containing no remarkable quantity of carbonate of lime."[2] To show the protective power of water against cold, it is only necessary to state the well-known physical fact, that water is of greater specific gravity at 42° Fahrenheit than at the freezing point of 32°; and hence water in contact with the roots of grass is rarely below 40°, a degree of temperature not at all prejudicial to the living organs of plants. Professor Rennie, of King's College, London, has recently given another theory of irrigation. It was promulged by M. De Candolle of Geneva, in his *Physiologie Vegetale*, and his views have recently been corroborated by the experiments of M.r Macaire of Geneva, that plants exude an excretion from their roots into the soil, and that this excretion is detrimental to the healthy growth of the same kind of plants which produced it. Hence it is concluded that grasses do not continue permanently in a healthy state in the same site, because they are in time injuriously affected by their own excretions, which, encouraging the growth of plants of a different nature, such as mosses, they spring up and extirpate the grasses. It is supposed to be probable that every species of grass is not alike affected by its own, or the excrementitious matter from other grasses, and therefore some species withstand the poison longer than others. Now, the water of irrigation, in its descent through the soil and subsoil, washes away or carries off in solution the injurious excrementitious matter exuded by the grasses, and thereby cleanses the soil in which they are growing free of it. Hence the *perennial verdure* of *irrigated* grass.[3] These theories establish four advantages which are derivable from irrigation. It supplies moisture to the soil, necessary in dry seasons and in tropical countries; it affords protection to plants against the extremes of heat and cold; it disseminates manure most minutely to plants; and it washes away injurious matter from the roots of plants.

Whichever theory is adopted, or both of them, for they are not inconsistent with each other, the benefits derivable from irrigation are purely mechanical; they have no reference to chemical action. The opinion of Sir Humphry Davy, therefore, that "in the artificial watering of meadows, the beneficial effects depend upon many different causes, some *chemical*, some mechanical,"[4] appears very problematical. Chemical action only commences after irrigation has ceased. This conclusion will appear evident, when the following particulars have been considered.

The operation of water bringing matter into minute subdivision; the sediment which it contains when used in irrigation being minutely distributed around the stems of the plants; water protecting plants in irrigation against the extremes of heat and cold, by completely covering and embracing every stem and leaf; and the supplying of moisture to the soil, and washing excrementitious matter out of it, are all purely mechanical operations. Warping is obviously a mechanical operation. Could the hand of man distribute manure around the roots and stems of grass as minutely and incessantly as turbid water; could it place a covering of woollen manufacture upon each blade and around each stem of grass, as completely as water can embrace each plant and keep it warm; could it water the grass as quietly and constantly as the slow current of irrigation; and could it wash away injurious matter from the soil as delicately around the fibres of the roots of grass as irrigating water, there would be no need of irrigation; the husbandman could then command at will verdant pasturage for his flocks and herds throughout the year, and in the driest season. His mechanical agency would be as effective as that of irrigation. But the relative powers of things being as at present constituted, man employs irrigation as the instrument of his will, and attains the maintenance of his live-stock by inducing Nature to assist him in a work in which she undoubtedly displays her superiority over him both in industry and dexterity. (K. K. K.)

IRRITABILITY, in *Anatomy* and *Medicine*, a term first invented by Glisson, and adopted by Haller, to denote an essential property of all animal bodies, which exists independently of, and in contradistinction to, sensibility. This ingenious author calls that part of the human body *irritable*, which becomes shorter upon being touched; *very irritable*, if it contracts upon a slight touch; and the contrary, if by a violent touch it contracts but little. He calls that

[1] Vancouver's *Cambridgeshire*.
[2] *Agricultural Chemistry*, 4to edition, p. 305.
[3] *Quarterly Journal of Agriculture*, vol. v. p. 24.
[4] *Agricultural Chemistry*, p. 305.

a sensible part of the human body, which, upon being touched, transmits the impression thereof to the soul; and in brutes, he calls those parts sensible, the irritation of which occasions evident signs of pain and disquiet in the animal. On the contrary, he calls that insensible, which being burned, torn, pricked, or cut till it is quite destroyed, occasions no sign of pain or convulsion, nor any sort of change in the situation of the body. From the result of many cruel experiments, Haller concludes that the epidermis is insensible; that the skin is sensible in a greater degree than any other part of the body; that the fat and cellular membrane are insensible; and that the muscular flesh is sensible, its sensibility being ascribed by him rather to the nerves than to the flesh itself. The tendons, he says, having no nerves distributed to them, are insensible. The ligaments and capsulæ of the articulations are also believed to be insensible; and hence Haller infers, that the sharp pains of the gout are not seated in the capsulæ of the joint, but in the skin, and in the nerves which creep upon its external surface. The bones are all insensible, says Haller, except the teeth; and likewise the marrow. Under his experiments, the periosteum and pericranium, the dura and pia mater, appeared insensible; and he infers, that the sensibility of the nerves is owing to the medulla, and not to the membranes. The arteries and veins are held to be susceptible of little or no sensation, excepting the carotid, the lingual, temporal, pharyngal, labial, thyroidal, and the aorta near the heart, the sensibility of which is ascribed to the nerves that accompany them. Sensibility is allowed to the internal membranes of the stomach, intestines, bladder, ureters, vagina, and womb, on account of their being of the same nature with the skin; the heart is also admitted to be sensible, but the lungs, liver, spleen, and kidneys, are possessed of a very imperfect, if any, sensation. The glands, having few nerves, are endowed with only an obtuse sensation. Some sensibility is allowed to the tunica choroides and the iris, though in a less degree than the retina; but none to the cornea. Haller concludes, in general, that the nerves alone are sensible of themselves; and that, in proportion to the number of nerves apparently distributed to particular parts. such parts possess a greater or less degree of sensibility.

Irritability, he says, is so different from sensibility, that the most irritable parts are not at all sensible, and *vice versa.* He alleges facts to prove this position, and also to demonstrate, that irritability does not depend upon the nerves, which are not irritable, but upon the original formation of the parts which are susceptible of it. Irritability, he says, is not proportioned to sensibility; and in proof of this, he observes, that the intestines, though rather less sensible than the stomach, are more irritable, and that the heart is very irritable, though it has but a small degree of sensation.

Irritability, according to Haller, is the distinguishing characteristic between the muscular and cellular fibres; and hence he determines that the ligaments, periosteum, meninges of the brain, and all the membranes composed of the cellular substance, are void of irritability. The tendons are not irritable; and though he does not absolutely deny irritability to the arteries, yet his experiments on the aorta produced no contraction. The veins and excretory ducts are in a small degree irritable, and the gall-bladder, the ductus choledochus, the ureters and urethra, are only affected by a very acrid corrosive; but the lacteal vessels are considerably irritable. The glands and mucous sinuses, the uterus in quadrupeds, the human matrix, and the genitals, are all irritable; as are also the muscles, particularly the diaphragm. The œsophagus, stomach, and intestines, are irritable; but of all the animal organs, the heart is endued with the greatest irritability. In general, there is nothing irritable in the animal body but the muscular fibres; and the vital parts are the most irritable. This power of motion, arising from irritations, is supposed to be different from all other properties of bodies, and probably resides in the glutinous mucus of the muscular fibres, altogether independently of the influence of the soul. The irritability of the muscles is said to be destroyed by drying the fibres, congealing the fat, and more especially by the use of opium in living animals. The physiological system, of which an abstract has now been given, has been adopted and confirmed by Castell and Zimmermann, and also by Brocklesby, who suggests, that irritability, as distinguished from sensibility, may depend upon a series of nerves different from such as serve either for voluntary motion or sensation. This doctrine, however, has been controverted by M. le Cat, and particularly by Dr Whytt, in his Physiological Essays.

IRROGATIO, a term of the Roman law, signifying the instrument in which were put down the punishments that the law provided against such offences as any person was accused of by a magistrate before the people. These punishments were first proclaimed *viva voce* by the accuser, and this was called *Inquisitio.* But the same being immediately afterwards expressed in writing, took the name of *Rogatio,* in respect of the people, who were to be consulted or asked about it, and was called *Irrogatio* in respect of the criminal, as it imported the mulct or punishment assigned him by the accuser.

IRROMANGO, or ERROMANGO, one of the New Hebrides islands, is about 24 or 25 leagues in circuit; the middle of it lies in Lat. 18° 54′ S.; Long. 169° 19′ E. See AUSTRALASIA.

IRTISH, a large river of Asia, in Siberia, which rises amongst the hills of the country of the Kalmucks, and, running north-east, falls into the Oby near Tobolsk. It abounds with fish, particularly sturgeon, and delicate salmon.

IRVINE, a seaport town and royal burgh of Scotland, in the bailiwick of Cunningham, and county of Ayr; it is agreeably situated at the mouth of a river of the same name on the Frith of Clyde, at the distance of eleven miles north of Ayr, sixty-seven from Edinburgh, twenty-five south-south-west of Glasgow, and six and a half west of Kilmarnock. It is a town of considerable antiquity, as appears by the records of the burgh, Alexander II. having granted a charter to the burgesses, confirming some other royal grants. It is a small but thriving place, consisting, besides smaller streets, of one broad street, running from south-east to north-west the whole length of the town, on the south side of the river, but connected with the town by a bridge. The road leading to the harbour is lined by a row of houses on either side, and mostly inhabited by seafaring people; and the road leading to Ayr is provided with houses in the same way. The bridge of Irvine is the widest and handsomest in the county. This burgh possesses a town-house, a parish church, and three other places of worship. There is an excellent academy, in which the higher branches are taught, a subscription free-school, several private schools, a news-room, and a subscription library. This port had formerly employed in the herring fishery several busses, that is, vessels fitted out under certain regulations to entitle them to a bounty. At present there are about one hundred vessels belonging to the port, tonnage 11,000, navigated by about seven hundred and thirty men. About twenty-one of these vessels are employed in the North American trade, three or four in the Mediterranean, one to India, and the remainder in the Irish or coast trade. There is a considerable timber and grain trade at this port, and a very extensive coal-trade. In 1834, the quantity of coal exported, principally to Ireland, was 91,462 chalders, equal to about 137,600 tons. The annual revenue of customs is from L.3000 to L.4000. Ship-building, chain, cable, and rope-making are carried on to some extent in Irvine. As a royal burgh it is governed by a provost, two bailies, a dean of guild, treasurer, and twelve councillors. The population of the town and parish was 7007 in 1821, and 7200 in 1831.

ISAAC, the Jewish patriarch, and an example of filial obedience, died 1716 before Christ, aged one hundred and eighty years.

ISÆUS, a celebrated Greek orator, whose birth-place was uncertain even in the time of Dionysius of Halicarnassus, who treats of him at considerable length. Some thought him a native of Athens, and others of Chalcis, in the island of Eubæa. The precise dates of his birth and death are not given, but we know that he flourished after the Peloponnesian war, about B. C. 400, and continued to take part in public affairs till the reign of Philip, B. C. 364. He was the pupil of Lysias and Isocrates, but he is chiefly distinguished as being the master of Demosthenes, who seems to have preferred him to all the orators of that age. The style of Isæus so much resembled that of Lysias, that Dionysius says it was difficult to distinguish them. It is simple, elegant, and full of vivacity, so that it has passed into a proverb, *Isæo torrentior*. (*Juv.* iii. 74.) He was chiefly employed in courts of law, and all the orations of his which have been preserved, were delivered in defence of his clients. Of sixty-four which were attributed to him, of which fourteen were considered as apocryphal in the time of Photius, there are only ten now preserved. The most esteemed edition of his works is that of *Reiske*, Leipsic, 1775, and of *Shoëmann*, Gryphiswald, 1831. They have been translated into English by W. Jones, London, 1779; into French by Auger, Paris, 1783; and into German by Shoëmann, Stuttgart, 1830. Another discourse of Isæus (*De Meneclis Hæreditate*) was discovered in a manuscript of the Library of St Lawrence, at Florence, and published by Tyrwith, London, 1785.

This Isæus ought not to be confounded with Isæus, another celebrated orator, who lived at Rome in the time of Pliny the younger, about the year 97.

ISAIAH, or *the Prophecy of Isaiah*, a canonical book of the Old Testament. Isaiah is the first of the four greater prophets; the other three being Jeremiah, Ezekiel, and Daniel. This prophet was of royal descent, his father Amos being brother to Azariah king of Judah. The first five chapters of his prophecy relate to the reign of Uzziah; the vision in the sixth chapter happened in the time of Jotham; the following chapters, to the fifteenth, include his prophecies under the reign of Ahab; and those which were made under the reigns of Hezekiah and Manasseh, are related in the subsequent chapters to the end. Isaiah foretold the deliverance of the Jews from their captivity in Babylon by Cyrus, one hundred years before it came to pass. But the most remarkable of his predictions are those concerning the Messiah, which describe not only his descent, but all the remarkable circumstances of his life and death. The style of this prophet is noble, nervous, and sublime, insomuch that Grotius calls him the Demosthenes of the Hebrews. However, the profoundness of his thoughts, the loftiness of his expressions, and the extent of his prophecy, render him one of the most difficult of all the prophets; and the commentaries which have been hitherto written on his prophecy fall short of a full explication of it. Bishop Lowth's translation, published in 1778, throws considerable light on the composition and meaning of *Isaiah*.

ISAURA, or Isaurus, in *Ancient Geography*, a strong city of Mount Taurus, in Isauria, which was twice demolished; first by Perdiccas, or at least by the inhabitants, who, through despair, destroyed themselves by fire, rather than fall into the hands of the enemy; again by Servilius, who thence took the surname *Isauricus*. Strabo says there were two Isauras, the old and the new, but so near that they were often confounded.

ISAURIA, a rugged and mountainous country, touching Pamphylia and Cilicia on the north, situated almost in Mount Taurus, and taking its name from Isaura; and, according to some, extending by a narrow slip to the Mediterranean. Stephanus, Ptolemy, and Zosimus, make no mention of places on the sea; though Pliny and Strabo do; but the latter are doubtful whether these are places in Isauria Proper, or in Pamphylia, or in Cilicia.

ISCA Dumniorum, in *Ancient Geography*, a town in Britain; now Exeter, capital of Devonshire. Lat. 5° 44′, Long. 3° 40′ W.

Isca *Silurum*, in *Ancient Geography*, the station of the *Legio Augusta Secunda* in Britain; now *Caerleon*, a town of Monmouthshire, on the Uske.

ISCHALIS, or Iscalis, in *Ancient Geography*, a town of the Belgæ in Britain; now *Ilchester*, in Somersetshire, on the river Ill.

ISCHIA, an island in the Mediterranean Sea, on the north-west side of the Bay of Naples, of volcanic origin, but fertile in wheat, wine, and fruits. It contains about twenty-seven square miles. The mountain Spomea, in height 2500 feet, is an extinguished volcano, but has woods and good pasture land, and several dairies are maintained, in which excellent cheese is made. It contains the capital, of the same name as the island, with 3140 inhabitants. The whole of the population amounts to 22,470 persons, who are active in producing silk, wine, excellent oil, and various kinds of fruit.

ISCHURIA, ισχουρια (formed from ἰσχω, *I stop*, and ὀυρον, *urine*), in *Physic*, a disease consisting in an entire suppression of urine.

ISELASTICS, a kind of games, or combats, celebrated in Greece and Asia, in the time of the Roman emperors. The victors at these games had very considerable privileges conferred on them. They were crowned on the spot immediately after their victory, had pensions allowed them, were furnished with provisions at the public cost, and were carried in triumph to their own country.

ISELWORTH, a town of the county of Middlesex, in the Hundred of the same name, eight miles from London. It is pleasantly situated on the banks of the Thames, and contains Sion House, belonging to the Duke of Northumberland, and several other mansions of high respectability. The principal industry is exercised in gardening, for the supply of the metropolis. The inhabitants amounted in 1801 to 4346, in 1811 to 4661, in 1821 to 5269, and in 1831 to 5590.

ISENBERG, now a province of the principality of Hesse Cassel, having been added to it when the former sovereign, who is still the chief proprietor, was mediatised. It is about 100 square miles in extent, is a hilly district, with extensive woods, is watered by the rivers Kinzig and Bracht, and the population living in four market-towns and forty-four villages, to the amount of 47,500, subsist chiefly by agricultural occupations. None of the four towns in it, except Berstein, has a thousand inhabitants.

ISERE, a department of the south of France, formed out of the ancient divisions of Graisivaudan and Bienois, which were formerly portions of Dauphiné. It extends over 3564 square miles, or, according to the royal almanack, 841,230 hectares. It is divided into four arrondissements, and these into 45 cantons, with 558 communes, having 471,660 inhabitants. The latter mostly adhere to the Catholic Church, but there are about 7000 Protestants. The common language is a patois, composed of Celtic, Latin, French, Italian, and Greek, but in which the Latin words predominate. The pure French, with the southern accent, is generally spoken in the towns. The face of the country is generally hilly, and in many parts mountainous, exhibiting most picturesque natural scenery, rising gradually from the plain through which the Rhone flows to the lofty elevations bordering on Savoy, where the highest of them, the Col de Saix, is 10,296 feet above the level of the sea. Some of the numerous valleys which extend between the ranges of mountains are of peculiar beauty, especially the valley of the Isère or Graisivaudan, which is nearly fifty miles in length, and considered as the most delightful district of France. It resembles a well cultivated garden, through which, with many windings, the river flows, between meadows and corn-fields, where scattered mulberry and other fruit trees, fine vineyards, and small woods on the sides of the hills, are ornamented by country houses and neat villages intermingled amongst them. Though, from the elevation, a great portion of the department remains uncultivated, and is incapable of cultivation, yet the other portions are fertile and highly productive. The soil is sandy, mixed with small shells in the valleys, resting on granite, and is easily worked; it is well irrigated, and adapted to almost every vegetable production. The only navigable rivers are the Rhone and the Isère, whose contributary streams are numerous. There are also some canals, which serve the double purpose of navigation and of irrigation. There are several mountain lakes within the department, and some of them are 7548 feet in height. The climate varies with the elevation; some of the eastern sides of the mountains are constantly covered with snow, whilst the valleys are in summer intensely hot. The chief agricultural products are wheat, maize, barley, potatoes, hemp, flax, rapeseed, stone fruits, wine, chestnuts, filberts, and some medicinal plants, besides cattle and game. There are mines which yield small portions of silver, copper, iron, lead, and coal, but none of them is extensively worked. The manufactures are cotton, silk, and woollen goods, earthenware, gloves at the capital, Grenoble, in large quantities, fine linen, paper, glass, liqueurs and brandy. There is also much leather prepared for the glover's trade.

ISERLON, a city of Prussia, the capital of a circle of the same name in the Arensberg division of the province of Westphalia. It stands on the river Baaren, and is one of the first manufacturing places in the kingdom for silks, velvets, and ribbons, and also has manufactories of cutlery, and other iron goods, with extensive linen weaving and bleaching. It contains two Lutheran, one Reformed, and one Catholic church, 786 houses, and 5690 inhabitants. Lat. 51° 25′ 6″, and Long. 7° 35′ 22″ E.

ISH, in *Scotch Law*, signifies *expiration*. Thus we say "the *ish* of a lease." It signifies also *to go out*; thus we say "free *ish* and entry" from and to any place.

ISIA, Ισεια, feasts and sacrifices anciently solemnized in honour of the goddess Isis. The Isia were full of the most abominable impurities, for which reason, those who were initiated into them were obliged to take an oath of secrecy. They were held for nine days successively, but grew so scandalous, that the senate abolished them at Rome, under the consulate of Piso and Gabinius. They were re-established by Augustus, and the Emperor Commodus himself assisted at them, appearing amongst the priests of that goddess with his head shaven, and carrying the Anubis.

ISIAC TABLE, is one of the most considerable monuments of antiquity discovered at Rome in 1525, and supposed, by the various figures in bas-relief upon it, to represent the feats of Isis, and other Egyptian deities. There have been various opinions as to the antiquity of this monument. Some have supposed that it was engraved long before the time when the Egyptians worshipped the figures of men and women; but others, amongst whom is Bishop Warburton, apprehend that it was made at Rome by persons attached to the worship of Isis. Dr Warburton considers it as one of the most modern of the Egyptian monuments, on account of the great mixture of hieroglyphic characters which it bears.

ISIACI, priests of the goddess Isis. Dioscorides tells us, that they bore a branch of sea wormwood in their hands instead of olive. They sung the praises of the goddess twice a-day, namely, at the rising of the sun, when they opened her temple, after which they begged alms the rest of the day, and returning at night, they repeated their orisons, and shut up the temple. The Isiaci never covered their feet with any thing but the thin bark of the plant papyrus, which occasioned Prudentius and others to say that they went barefooted. They wore no garments except linen, because Isis was the first who taught mankind the mode of preparing this commodity.

ISIDORUS, called DAMIATENSIS, or PELUSIOTA, from his having lived in a solitude near that city, was one of the most famous of all St Chrysostom's disciples, and flourished in the time of the general council held in 421. We have upwards of two thousand of his epistles in five books. They are short, but well written, in Greek. The best edition is that of Paris, in Greek and Latin, printed in 1638, in folio.

ISIS, a celebrated deity of the Egyptians. Some suppose her to be the same as Io, who was changed into a cow, and restored to her human form in Egypt, where she taught agriculture, and governed the people with mildness and equity, for which reasons she received divine honours after death. According to some tarditions mentioned by Plutarch, Isis married her brother Osiris, and was pregnant by him even before she had left her mother's womb. These two ancient deities, as some authors observe, comprehended all nature and all the gods of the heathens. Isis was the Venus of Cyprus, the Minerva of Athens, the Cybele of the Phrygians, the Ceres of Eleusis, the Proserpine of Sicily, the Diana of Crete, and the Bellona of the Romans. Osiris and Isis reigned conjointly in Egypt; but the rebellion of Typhon, the brother of Osiris, proved fatal to this sovereign. The ox and the cow were the symbols of Osiris and Isis; because these deities, whilst on earth, had diligently applied themselves to the cultivating of the earth. Since Isis was supposed to be the moon, as Osiris was the sun, she was represented as holding a globe in her hand, with a vessel full of ears of corn. The Egyptians believed that the yearly and regular inundations of the Nile proceeded from the abundant tears which Isis shed for the loss of Osiris, whom Typhon had basely murdered. The word *Isis*, according to some, signifies "ancient," and on that account the inscriptions on the statues of the goddess were often in these words: "I am all that has been, that shall be; and none amongst mortals has hitherto taken off my veil." The worship of Isis was universal in Egypt, and her priests were obliged to observe perpetual chastity; their heads were closely shaved, and they always walked barefooted, and clothed themselves in linen garments. They never ate onions, they abstained from salt with their meat, and they were forbidden to eat the flesh of sheep and of hogs. During the night they were employed in continual devotion near the statue of the goddess. Cleopatra, the beautiful queen of Egypt, was wont to dress herself like this goddess, and affected to be called a second Isis.

ISIS, or *Thames*, a river that takes its rise in Gloucestershire, and flows through only a small part of Wiltshire. It enters this county near its source, and begins to be navigable for boats at Cricklade; but after running in a serpentine manner about four miles, it leaves Gloucestershire at a village called Castle Eaton.

ISJUM, a city of the province Ukraine in Russia, the capital of a circle of the same name on the river Jszumez, which near to it falls into the Donez. It is surrounded with walls, but in a neglected condition; and contains four churches, 718 houses, and 4500 inhabitants, whose chief trade consists in the sale of corn and cattle. Lat. 49° 12′ 30″ N.; Long. 37° 30′ 5″ E.

ISLA DE LA GENTE HERMOGA, or Island of Handsome

People, an island in the Pacific Ocean, discovered by Mendana, about six leagues in circumference. Lat. 10° S.; Long. 175° 10′ W.

ISLA DE LEON, a city of Spain, in the kingdom of Seville, and in the province of Andalusia. It is a place generally containing 40,000 inhabitants, but from being within the line of defence of the Spanish troops and the garrison of Cadiz, during the siege it was supposed to contain more than double that number. When the French armies were in possession of the rest of Spain, this city became the refuge of the loyal party, the place of assembly for the national representatives, and the seat of the government. From being near the arsenal of Caraccas, the officers and workmen employed there, found it convenient to take up their residence in this city. The streets are wide, the houses large, the public buildings splendid, and its whole appearance gives it an air of great magnificence. It is separated from the continent by the narrow but navigable river Sante Petri, over which is an ancient bridge called Puente de Zuarzo, generally, but erroneously, believed to have been built by Julius Cæsar; it is, however, known to have been erected by Cornelius Balbo the younger, seventeen years before the Christian era. The foundations are now the same as then existed, but the upper works, and some of the arches, were built in 1437. On both sides, but especially towards the continent, the river has extensive and boggy marshes, which can only be crossed by means of a narrow causeway, exposed to the attacks of several heavy batteries. The strength of this place, and the secure retreat from it to Cadiz, of still greater strength in case of emergency, made it the natural and valuable asylum of all that remained of freedom in Spain from the year 1810, till the result of the battle of Salamanca compelled the French to evacuate Andalusia. The marshes on the banks of the Sante Petri afford prodigious quantities of salt, crystallized by the heat of the sun. It is piled in heaps of a pyramidical form; and when the rain dissolves the upper part, the sun crystallizes it again, and thus forms a roof of a solid cake of salt, and defends the heap from the future effects of any bad weather. It is permitted to be exported on payment of a very trifling duty, and numerous ships are loaded with it. What is conveyed to the interior becomes the subject of a royal monopoly, and is subject to a very heavy tax. Lat. 38° 53′ 16″ N.; Long. 5° 40′ 31″ W.

ISLAM, or ISLAMISM; the true faith, according to the Mahommedans. See MAHOMMEDANISM.

ISLAMABAD, a town of Bengal, in the district of Chittagong, of which it is the capital. It is situated on the western bank of the Chittagon, near about ten miles from its junction with the sea. It carries on a considerable trade, and ships are also built there, and sent to Calcutta for sale. This town was early known to the Portuguese, by whom it was called Porto Grando. It was taken from the rajah of Arracan by the Moguls in 1666; and was at that period well fortified with 1200 cannon. Its name was changed from Chittagong to Islamabad. In 1689, the English made an unsuccessful assault upon it. Since it was ceded to the British in 1760, the fortifications have been allowed to go into decay. The entrance to the river is dangerous without a pilot, as it has only four fathoms over the bar, and afterwards deepens to from five to seven fathoms. The entrance to the river is in 22° 13′ N. The town stands in long. 91° 42′ E.; lat. 22° 22′ N. This is also the name of a considerable town of Cashmeer, situated on the north side of the river Ihytyur, over which is a wooden bridge eighty yards in length. Its houses are built of stone, with gardens on their roofs; and its principal manufacture is shawls. Lat. 34° 6′ N.; Long. 74° 7′ E.

ISLAMNAGUR, a town of Hindostan, in the Mahratta territories, province of Malwah, five miles north-east from Bossal, in lat. 23° 19′ N.; long. 77° 31′ E. There are many small places of this name in Hindostan.

ISLAMPOOR. There are two towns of this name in Hindostan, one in the province of Ajmeer, seventy-seven miles north from Zeypoor. Lat 27° 4′ N.; long. 75° 23′ E. Another in the province of Bahar, district of Bahar, thirty-five miles south from Portna. Lat. 25° 7′ N.; long. 85° 15′ E.

ISLAND, a tract of dry land encompassed with water; in which sense it stands contradistinguished from CONTINENT, or TERRA FIRMA.

ISLE, a city of the arrondissement of Gaillac, in the department of the Tarn in France. It stands on the river Tarn, and is an ill-built manufacturing town, containing 6520 inhabitants, who make various kinds of woollen goods, and trade largely in wine.

ISLEBIANS, in ecclesiastical history, a name given to those who adopted the sentiments of a Lutheran divine of Saxony, called John Agricola, a disciple of Luther, and a native of Isleb, who, interpreting literally some of the precepts of St Paul regarding the Jewish law, declaimed against the necessity of good works. See ANTINOMIANS.

ISLINGTON, a large parish in the hundred of Ossulton, in the county of Middlesex, one mile and a half from London. It rises in a gentle declivity from the metropolis, but, by the houses connecting with it, appears to be only a prolongation of the city. It is chiefly occupied by persons carrying on trade in London, or by those who have retired from commerce. It contains no very splendid mansions, but a great number of respectable and comfortable dwellings. It contains the hamlets of Upper and Lower Holloway, and part of Newington Green and Kingsland. Being on the great north road, carriages are passing through it at all hours. Besides the parish church it has three others, and chapels for sectaries of every description. The New River passes through the parish, and the Regent's Canal. The latter, by a tunnel, goes under the principal street, and under the New River, and thus conveys coals and other heavy articles from the Thames at a cheap rate. The New River head, from which a great part of the metropolis is supplied with water, is in this parish, as well as the minor theatre known as Sadler's Wells. A mineral water here was once frequented for its medicinal qualities, but the fashion seems to be changed, as it is now rarely resorted to. A collegiate institution has been lately founded at Highbury in this parish, for the education of dissenting ministers of the class of Independents. The population of the parish amounted in 1801 to 10,212, in 1811 to 15,065, in 1821 to 22,417, and in 1831 to 37,316.

ISMAELITES, the descendants of Ismael, dwelling from Havila to the wilderness of Sur, towards Egypt, and thus overspreading Arabia Petræa; wherefore Josephus calls Ismael the founder of the Arabs.

ISMAIL, a town of the Russian province Bessarabia, the capital of a circle of the same name. It is situated on an arm of the Danube, is strongly fortified, and has become celebrated for the carnage which attended its capture in 1789 by Suwarrow. Since that period it has not recovered its former importance, and contains but few inhabitants, with little commerce or produce. Lat. 45° 21′ 30″; Long. 28° 44′ 35″ E.

ISMARUS, in *Ancient Geography*, a town of the Cicones in Thrace, giving name to a lake, and by Virgil called Ismara.

ISMID, a town of Asia Minor, the ancient Nicomedia, capital of Bithynia. It retains no traces of its former grandeur, nor any antiquity, except the remains of a church. It contains 750 families, and is situated on the side of a hill overlooking the Gulf of Nicomedia. Lat. 40° 39′ N.; Long. 29° 34′ E.

ISMIK, a town of Asia Minor, the ancient Nice, which now contains scarcely 300 houses, yet exhibits numerous monuments of ancient grandeur. It is situated on a lake communicating with the Sea of Marmora, and carries on some trade in silk. This place is famous in ecclesiastical history, as the seat of two councils, in 325 and 387. During the period of the crusades, it became the capital of a kingdom erected along the coast of Asia Minor. The old walls of the town may be still traced over a circumference of four miles. Lat. 40° 16′ N.; Long. 29° 50′ E.

ISOCHRONAL, is applied to such vibrations of a pendulum as are performed in the same space of time; as are all the vibrations of the same pendulum, whether the arches it describes be longer or shorter.

ISOCHRONAL *Line*, that in which a heavy body is supposed to descend without any acceleration.

ISOCRATES, one of the most celebrated rhetoricians of Athens, was born, B. C. 436, five years before the beginning of the Peloponnesian war, twenty-two years after the birth of Lysias, and fifty-four after that of Demosthenes. He died B. C. 338. He was son of Theodorus, who was a manufacturer of musical instruments, but, though of humble parentage, he seems to have enjoyed the best education which Athens could furnish. His early years were spent under Gorgias of Leontium, one of the most celebrated sophists of the age; Prodicus of Ceos, whose beautiful apologue of Hercules between Virtue and Vice, has immortalized his name; and Theramenes, who was afterwards condemned to death by the thirty tyrants, because, though their colleague, he refused to participate in their tyranny. With their assistance, Isocrates soon began to display the talents of which he was possessed, and became anxious to illustrate his name as a statesman and legislator. Nature, however, it would appear, had placed an impassable barrier against his entrance on public life, by furnishing him with a weak voice and timidity of nature which he found himself unable to overcome. Thus prevented from pursuing the path to which his inclination pointed, he determined to make his talents subservient to his fortune. He opened a school for oratory, and soon found himself surrounded by a numerous body of young men anxious to profit by his instructions. Amongst the more celebrated we may mention Theopompus, Ephorus, Isæus, Timotheus, Philiscus, and Xenophon. So numerous were the disciples of Isocrates, that Hermippus composed a work in several books respecting them. The sophists of his time were accustomed to discuss subtile points of logical casuistry; Isocrates first distinguished himself by discussing the great political interests of the time, and examining important questions of morality. As his speeches were not intended to be delivered, but to be perused in the retirement of the closet, Isocrates was obliged to pay particular attention to beauty of style, to the rounding of his periods, and avoiding whatever might prove offensive to the ear. He is said to have been employed ten years in polishing one of the most celebrated of his productions, entitled the *Panegyric*. It might be expected that this mode of proceeding would be attended with some defects; it occasioned a want of animation, a constant monotony, and often an enfeebling of the ideas, which were enveloped in a multitude of words, useful only to round the period and to produce the necessary rhythm and cadence. He was not always able to secure himself against the envy of his countrymen, and they even accused him of holding a suspicious intercourse with Philip of Macedon, with whom he kept up a constant correspondence; but he proved, by the closing scene of his life, that his intentions had always been pure, and that he had sincerely loved his country. After the battle of Chæronea, B. C. 338, so fatal to the liberties of Greece, he determined no longer to drag on a life which would be embittered by seeing his country subject to the Macedonians. He preferred to starve himself to death. Of his works we still possess twenty-one orations and nine letters. The first is addressed to Demoricus, of whom we know nothing, and is a collection of remarks and maxims for the direction of a young man's conduct. It is attributed by some critics to Isocrates of Apollonia, who is mentioned by Suidas and Harpocration. One of the finest of his productions is the *Panegyric* (Πανηγυρικος), which was written B. C. 380, with the view of putting an end to the internal dissensions of the Greeks, and inducing them to unite against the Persians. We may also mention the oration entitled Παναθηναικος, as one of the best specimens of his peculiar style, though it was composed, B. C. 342, at the advanced age of ninety-four. It is a high panegyric on the Athenians and their ancestors. Numerous editions of his works have been published. The *editio princeps* was printed at Milan in 1493, by Demetrius Chalcondylas, but the best is that by Coray, Paris, 1807. The Panegyric has been published separately by Morus, 1803, by Pinzger, Lips. 1825, and by Dindorf, Lips. 1826. Many of his other works have also been published separately.

ISOPERIMETRICAL FIGURES, in *Geometry*, are such as have equal perimeters or circumferences.

ISOSCELES TRIANGLE, in *Geometry*, one that has two equal sides.

ISPAHAN, from time immemorial the capital of the Persian monarchy, and long celebrated as one of the most splendid cities of the East, though now nearly in a state of ruin and decay. Its original name is said to have been Sipahan, which it received from the Persian kings, in consequence of its having been the general place of rendezvous for their armies. The origin of this city is lost in a remote antiquity; but it is generally supposed to have arisen from the ruins of Hecatompylos, the capital of Parthia; whilst some will have it to stand on the site of the Aspa or Aspadura of Ptolemy. It is well adapted, from its central situation with the noble river Zeinderood flowing through it, for the capital of the empire. It was under the caliphs of Bagdad that it rose to be the capital of Irak, and under their powerful protection it soon increased in wealth, population, and trade. The invasion of Timor gave a fatal blow to its rising prosperity. Ispahan was taken by his conquering army in the year 1387; and at first he contented himself with exacting a large contribution from its inhabitants But being apprised that the inhabitants meditated a nocturnal insurrection against his troops, he gave up the place to military execution; and in the indiscriminate massacre which followed, it is computed that 70,000 inhabitants perished; indeed their heads piled up in heaps on the walls of Ispahan, attested the merciless severity of the conqueror. From this desolation, owing to its favoured situation, it quickly revived; and under the early sophis great efforts were made to restore its former prosperity. But it was reserved for the renowned Shah Abbas to raise it to the height of royal magnificence, and to render it not only a luxurious capital, but the great emporium of the Asiatic world. During his reign it contained nearly a million of people, and to supply its markets required the labour of 1400 villages, whose inhabitants drew their subsistence from its prosperity. "Its bazaars," says Sir R. K. Porter, "were filled with merchandize from every quarter of the globe, mingled with the rich bales of its own celebrated manufactures."[1] It was the scene of industry, diligence, and activity; whilst the court of the great king was the resort of ambassadors from the proudest kingdoms of the East, as well as from Europe; and travellers visited it, to behold its splendours, and to enjoy the gracious reception bestowed by its monarch on the learned and ingenious of all nations. It was visited by Chardin at the beginning of the eighteenth century, and its mag-

[1] See *Travels in Georgia, Persia, &c.*, vol. i. p. 407, *et seq.*

Ispahan. nificence was such, that no city of the East could compare with it, except the capitals of Hindostan and China. Such was the state of Ispahan during the reign of Abbas the First, and also during the subsequent reign of the second Abbas. In 1722, it was taken by the Afghans, when all its prosperity and splendour were for ever extinguished by those merciless invaders. The people were massacred without mercy; the most superb edifices erected by the Persian kings were reduced to ruins; and the wall which formerly surrounded the city was entirely destroyed by them. In 1727 it was retaken by Nadir Shah, who took no pains, however, to restore its prosperity. Since this period, Ispahan has never again been a royal residence, the late sovereigns of Persia having preferred a more northern capital, particularly Teheran; and Ispahan, instead of being repaired and beautified as formerly, has gone more and more into decay, and now presents little else than a scene of ruin. Its people are in fact reduced to scarcely one-tenth of their former numbers; the streets are everywhere in ruin; the bazaars remain silent and unattended; the caravansaries are equally forsaken; its villages lie waste; and its palaces are solitary, the sounds of revelry, which were wont to be heard in the festive halls, being now succeeded by the howling of jackals and famishing dogs.

According to the ancient account of this city by Chardin, it was twenty-four miles in circuit, contained 172 mosques, 43 colleges, 1800 caravansaries, and 273 public baths. The most splendid edifice which adorned the city was the palace of Shah Abbas. It is said to have been five miles in circuit, and was divided into gardens and pleasure grounds, with summer-houses and other elegant structures. The extent and elegance of the buildings, the number and beauty of the fountains dispersed through the gardens, and the grandeur of the royal halls in the interior, are said to have surpassed any thing of the kind to be found in Europe. The walls and buildings of the palace remain still nearly entire; but it has been stripped of all its costly furniture, and every thing valuable that could be removed.

The Meydun is a large square, nearly one-third of a mile in length, and about one-half in breadth. It was formerly surrounded by a canal, bordered by very fine plane trees; but all vestiges of both are now obliterated. Its original purpose, by Shah Abbas, was for the display of horsemanship and military exercises, but it is now entirely devoted to trade, being the place of the city where the finest shops are to be found, with a second storey, in which mechanics have their working apartments; and in the middle is a market for horses and cattle. In the centre of this immense area stand some edifices remarkable for grandeur or for character. In the north-west we find the great gate or rather tower of entrance to the bazaar, on which in former times stood the celebrated clock of Ispahan. The south-eastern side of the quadrangle shews the Mesched Shah, a superb mosque, which Shah Abbas built and dedicated to Mehedi, one of the twelve imams. On the north-east is the mosque of Looft Ullah; and on the south-west the Ali-kapi, or gate of Ali, forms a majestic parallel to the bazaar porch on the opposite side. This is the most perfect piece of fine brick-work to be found in the Persian empire. Another remarkable object is the Chahar Bagh, or four gardens. The royal domain which bears that title, is a very extensive tract, inclosed with four majestic walls, and divided into gardens with pleasure-grounds. The prevailing plan of all these is that of long parallel walks, shaded by even rows of tall and umbrageous planes; and interspersed with a variety of fruit-trees, and of every kind of flowering shrub. Canals, which receive the waters of the Zeinderood, flow down the avenues in the same undeviating lines, and generally terminate in some large marble basin of a square or octagon shape, ornamented with sparkling fountains; the effect of the whole, though formal, being extremely grand. Many magnificent rivers and palaces opened into these grounds, which are now all destroyed. That at the east called Hooser Jereeb, one of the noblest edifices of Ispahan, was reduced into a heap of rubbish by the Afghans. Its garden, however, still remains, and is nearly a mile in extent. The object of this garden was to form a repository of the finest fruits which Persia produced, and which are still to be found there in the greatest perfection. The palace of Forty Pillars, which was the favourite residence of the Sefi kings, is said to exceed all our European ideas of splendour, and to realize the wonderful tales of the Arabian Nights' Entertainments. At a considerable distance from the Chehel Setoon, or the palace of the Forty Pillars, to the left of the gardens, stands the Winter Palace, containing the harem, royal arsenal, and stables, where Ashneff, the second tyrant of the Afghan invaders, held his short and cruel sway, which he stained with the blood of its native prince, the captive Shah Houssain. Close to the winter palace stands a superb structure, lately erected by the Nizam-a-Doulah, for the reception of his present majesty, should he ever visit the capital. The general style of the architecture is the same with that of the neighbouring palaces, but executed in a more light, simple, and elegant taste.

There are several very handsome bridges in Ispahan across the Zeinderood. They were all the work of Shah Abbas, built of brick, and on the same plan, being perfectly level, presenting the appearance of Roman aqueducts. Each bridge is formed of a long succession of small arches, over which the causeway is laid; and on that run two lines of arcades on each side of the bridge, affording a road for foot passengers, and leaving the middle part open for horsemen and cattle. The bridge which joins the Chaur Bang with the suburb of Julpha, is 1000 feet long, and has thirty-four arches. The streets of Ispahan are narrow, winding, and irregular; and being quite unpaved, the wind, in dry weather, raises such clouds of dust, that the sun cannot be seen. Great pains are in consequence bestowed in watering the streets. The houses within, though they are handsome and convenient, have a mean appearance from the street, being built merely of bricks dried in the sun, and covered with flat roofs. The walls by which the city was formerly surrounded, are now entirely obliterated. They were merely built of mud dried in the sun, and were never able to offer any effectual resistance against a vigorous assault.

Ispahan, during its prosperity, was greatly distinguished by the extent and beauty of its suburbs. The suburb of Julpha was very wealthy and populous. It was chiefly inhabited by Armenians, who were transferred here from Old Julpha in Armenia, on account of their skill in manufacturing industry. They were soon joined by others of their countrymen, as well as by a number of Georgians, Circassians, and other Christians, the suburbs being appropriated to the professors of that faith. The streets are broad, with well built houses and a numerous population, with walks of trees, cooling fountains, and pleasant gardens. It is now reduced to a complete ruin. Its 10,000 inhabitants have diminished to 300 wretched families, dwindling every year both in respectability and numbers; its thirteen churches are reduced to two, and these dirty and dark and dismal in their appearance. The worship of the Guebres, the ancient worshippers of fire, and that of Abbas Adab, formerly very extensive, have quite disappeared.

Ispahan, after such a long period of misery and desolation from foreign wars and internal revolutions, has begun to revive from its low state, partly through the spontaneous efforts of its inhabitants, anxious to better their condition, and partly also through the exertions of Hajee Mahommed Hussein Khan, who, from the lowest situation, having acquired immense wealth, has employed it in the improvement of his native city and province. He has completed a royal palace, and has beautified and rebuilt many of the bazaars; repaired and added to the number of the fountains and aqueducts which supply the public gardens with water; and inclosed and cultivated all the waste land in the vicinity of the city, by planting rice fields, which are irrigated by the waters of the Zeinderood, and the cultivation of which is likely to supersede entirely its once abundant nurseries for cotton and silk. Ispahan has still very extensive manufactures. It excels in silk manufactures and in gold brocade; and it is also a great emporium of inland trade, and a depôt of Indian produce, being the chief medium of intercourse between India, Cabul, and the east, and Turkey, Egypt, and the countries round the Mediterranean, in the west. Lat. 32° 25′ N.; Long. 52° 50′ E.

ISPIRA, a town of Turkish Armenia, the ancient Hispiratis, now an inconsiderable town, but situated in a very fertile district, and surrounded by many fine and rich villages. It is ninety miles east of Trebisond.

ISRAEL, the name which the angel gave to Jacob, after having wrestled with him all night at Mahanaim or Penuel (Gen. xxxii. 1, 2, and 28, 29, 30, and Hosea xii. 3). It signifies "a conqueror of God," or "a prince of God," or, according to many of the ancients, "a man who sees God." By the name of Israel is sometimes understood the person of Jacob; sometimes the whole people of Israel, or the whole race of Jacob; and sometimes the kingdom of Israel, or of the ten tribes, distinct from the kingdom of Judah.

ISRAELITES, the descendants of Israel, who were at first called *Hebrews*, by reason of Abraham, who came from the other side of the Euphrates; and afterwards *Israelites*, from Israel the father of the twelve patriarchs; and, lastly, *Jews*, particularly after their return from the captivity of Babylon, because the tribe of Judah was then stronger and more numerous than the other tribes.

ISSACHAR, one of the divisions of Palestine by tribes, situated to the south of Zabulon, and by a narrow slip reaches the Jordan, between Zabulon and Manasseh (Joshua, xix). But whether it reached to the sea, is uncertain. Some hold that it did; but this is an assertion not easy to be proved, as Joshua makes no mention of the sea in this tribe, nor does Josephus extend it farther than to Mount Carmel; and in Joshua (xvii. 10) Asher is said to touch Manasseh on the north, which could not be if Issachar extended to the sea.

ISSENGEAUX, an arrondissement of the department of the Upper Loire in France, extending over 1200 square miles. It is divided into six cantons, and these into thirty-seven communes, which contain 76,306 inhabitants. The capital is a city of the same name, which contains 1050 houses, with 6571 inhabitants, who subsist chiefly by agricultural operations.

ISSIN, a small town of Persia, two miles north of Gombroon, to which many of the inhabitants of that city retire during the unhealthy season.

ISSOIRE, an arrondissement of the department of the Puy-de-Dôme in France, extending over 758 square miles, divided into nine cantons, composed of 116 communes, and inhabited by 95,500 persons. The capital is a city of the same name, situated on the river Crouse, which a little below falls into the Allier. It contains 730 houses and 5,479 inhabitants, who manufacture some jewellery. Lat. 45° 33′; Long. 3° 10′ E.

ISSOUDUN, an arrondissement of the department of the Indre in France, extending over 466 square miles, divided into four cantons, and those into fifty-three communes, and containing 39,887 inhabitants. The capital from which it takes the name, is a city which is situated on the river Theals, a second-rate stream. It is surrounded with ditches and walls, defended by towers, and contains 2050 houses, with 10,710 inhabitants. A great quantity of leather is cured in it, and there are many hats and stockings made. Lat. 46° 56′ 53″; Long. 1° 54′ 5″ E.

ISSUE, in common law, has various applications, being sometimes taken for the children begotten between a man and his wife; sometimes for profits growing from amercements or fines; sometimes for profits of lands and tenements; but more frequently for the point of matter depending in suit, upon which the parties join, and put their cause to the trial of the jury. In all these occasions, issue has but one signification, which is, an effect of a cause preceding; as the children are the effect of the marriage between the parents; the profits growing to the king or lord, from the punishment of any man's offence, are the effect of his transgression; and the point referred to the trial of twelve men is the effect of pleading, or process.

ISSURDU, a town of Hindostan, in the province of Asmeer, in the Rajpoot territories. It is surrounded with a wall and ditch, has a citadel in the centre, and is one of the best built towns in the province. Lat. 26° 26′ N.; Long. 76° 10′ E.

ISSUS, now Ajazo, a town of Cilicia in Natolia, with a harbour on the Levant sea, a little to the north of Scanderoon. Lat. 36° 56′ N.; Long. 36° 25′ E.

ISTAKHAR, a castle of Persia, formerly one of the citadels of Persepolis. It is situated on a very lofty and steep rock, and completely commands the surrounding plains. On the top is abundance of water.

ISTHMIA, or ISTHMIAN *Games*, one of the four solemn games which were celebrated every fifth year in Greece. They derived their name from the isthmus of Corinth, where they were celebrated. In their first institution, according to Pausanias, they consisted only of funeral rites and ceremonies in honour of Melicertes; but, as Plutarch informs us, Theseus, in emulation of Hercules, who had appointed games at Olympia in honour of Jupiter, afterwards dedicated these to Neptune, his reputed father, who was regarded as the partieular protector of the isthmus and commerce of Corinth. The same trials of skill were exhibited here as at the other three sacred games; particularly those of music and poetry. These games, in which the victors were only rewarded with garlands of pine leaves, were celebrated with great magnificence and splendour as long as Paganism continued to be the established religion of Greece; nor were they omitted even when Corinth was sacked and burned by Mummius the Roman general; at which time the care of them was transferred to the Sicyonians, but was again restored to the Corinthians when their city was rebuilt.

ISTHMUS, a narrow neck or slip of land, which connects two continents; or joins a peninsula to the terra firma, and separates two seas. The most celebrated isthmuses are that of Panama or Darien, which joins North and South America; that of Suez, which connects Asia and Africa; that of Corinth, which unites the Morea with Western Greece; that of Crim-Tartary, otherwise called *Taurica Chersonesus;* and that of the peninsula Romania, and Erisso, or the isthmus of the Thracian Chersonesus, twelve furlongs broad, being that which Xerxes undertook to cut through.

ISTRIA, a peninsula of Italy, in the territory of Venice, situated in the northern part of the Adriatic Sea. It is bounded by Carniola on the north; and on the south, east, and west, by the sea. It produces wine, oil, and pastures; and there are quarries of fine marble. One part of it belongs to the Venetians, and the other to the house of Austria. Capo d'Istria is the capital town.

ITALICA, in *Ancient Geography*, a town of Bætica in Spain, built by Scipio Africanus, and famous for being the birth-place of the emperors Trajan and Hadrian, and of the poet Silius Italicus. It is now *Seville Vieja*, a small village of Andalusia, on the Guadalquivir.

ITALY.

History.

This extensive and interesting portion of Europe did not receive the name it has long borne till the extension of the Roman empire. The origin of that name has been derived by different persons from various sources. Timæus and Varro have deduced it from a Greek word, Ιταλος, which signifies an *ox*, because it contains a vast extent of pasture land, peculiarly adapted to that animal. Thucydides and Dionysius of Halicarnassus derive the name from a king Italus. In early periods it was sometimes called Saturnia, from the name of a deity, Saturn, in the heathen mythology. It was sometimes called Œnotria, from a Sabine chief named Œnotrius; and frequently Ausonia, from Auson, a son of Ulysses, who is said to have established a tribe in the centre of the peninsula. All of these more ancient names seem, however, to have referred only to particular districts, which, when the Roman power had subjected them all, assumed, with the other parts subsequently united to them, the general name it still continues to bear. The Greeks at all times applied to it the name Hesperia, on account of its being to the westward from their country; and the Teutones or Germans called it Waelschland, because the parts nearest to them were inhabited by a people called Galles, changed into Walles; and in their present language the name of Waelschland is still retained by the common people.

The history of Italy before the rise of the Roman power is, like that of all rude nations, involved in obscurity, or clouded with indistinctness; through which the indefatigable Niebuhr, with a profusion of learning, has endeavoured to grope his way. Before Rome began to be powerful, Italy was peopled by inhabitants who had made some advances towards civilization. In the northern part the Gauls were rude and fierce, and they the longest resisted the encroaching power; whilst lower down, on the Arno and the Tiber, there was a number of smaller tribes, such as the Etruscans, the Samnites, and the Latins, who, in a kind of confederacy, though sometimes at variance with one another, long sought, and ultimately in vain, to defend their freedom against the rising and aspiring city. In the southern parts were colonies of emigrants from Greece, with but little union, and frequently engaged in hostilities amongst themselves. When and by what means all these tribes became finally subjected to Rome, belongs to the history of that empire; for the history of the conquered is swallowed up in that of the conquerors.

A. D. 476 to 568.

The fate of Italy was that of Rome till the dissolution of that colossal power. When the seat of empire was removed to Constantinople, Italy, though accounted a portion of the western empire, was treated as a dependent province, and continued with only the semblance of power, which power was finally wrested from all dependence on Byzantium by an adventurous Gothic warrior, who, about the year 476 of the Christian era, founded the kingdom of Italy.

Odoacer had raised himself, by his intrigues amongst the mercenary guards, to the command of those troops, who from inactivity had become restless and mutinous. Augustulus, the last emperor of the West, was unable to resist the power of his disaffected troops, and withdrew to Pavia. That city was besieged, captured, and ravaged, and Augustulus retired to obscurity, when Odoacer proclaimed himself king of Italy. He exercised the power with dignity, and, as regarded Augustulus, with clemency, by assigning him a liberal establishment, during the few years that remained of his life, in the retreat he had selected in Campania. Italy was in a wretched state, and Odoacer used as much prudence and humanity as could have been exercised by a rude conqueror, to improve the condition and the institutions of the country; but the licentious troops who had been the means of his obtaining it could not be kept in obedience by a power so created, and disorders became universal. When Odoacer had reigned fourteen years, Theodoric, king of the Ostrogoths, at the instigation of the Emperor Zeno, who reigned in Byzantium, invaded the newly-founded kingdom; defeated and assassinated Odoacer; and, in 493, added the whole of Italy to his dominions, which thus extended from the Alps to Sicily. The only part not subjected was some islands in the lagunes of the Adriatic Sea, inhabited by fishermen and salt-makers, who had first found a refuge in these from the ravages of Attila, and had there secured freedom, and by their union, and by the capability of defending themselves, laid the foundation of what subsequently became the republic of Venice. In the favoured climate of Italy, and under the government of Theodoric, the Goths multiplied rapidly; and they were almost the sole masters of the soil, and of the slaves who cultivated it. By his external policy he had acquired the confidence of the other Gothic tribes, even in the remote regions that border on the Baltic Sea, and had introduced strong and regular forms of government into Rhætia, Noricum, Dalmatia, and Pannonia. Though the jealousy of the emperor at Byzantium induced him to invade the territory commanded by Theodoric, and to employ both a large fleet and a powerful army, his attempts were repelled by sea and by land, and his forces were dispersed or dispirited, and retired from the contest.

Theodoric was not less successful in another attack from the west by King Clovis, the leader of the Franks, who were checked in the midst of a career which had commenced with brilliant success.

Ravenna was the seat of the government of this prince, though he occasionally resided at Verona. He once visited Rome, where he was received with rapture by the populace, and with the highest marks of respect by the senators. During the latter and peaceful portion of his reign he endeavoured to amalgamate his Italian and Gothic subjects; but his success was much obstructed by the religious controversy between the orthodox and the Arians, though, whilst adhering to the latter sect, he tolerated and even honoured many of the other profession. But a union was in some measure effected between the conquerors and the conquered, and civilization was advanced during this long reign, although at the sacrifice of the manly simplicity of the former to the corruption and luxurious indulgences of the latter.

Theodoric died in the palace he had built at Ravenna, in 526, after a reign of thirty-three years, having by his will divided his dominions between two grandsons, bequeathing Italy to Athalaric, then a boy of twelve years of age. The youthful sovereign was left under the pupillage of his mother Amalasontha, from which he was early withdrawn by the flatterers who surrounded him. His mother then entered into intrigues with the Emperor Justinian, tending to deliver up Italy to its ancient dependence on the court of Byzantium. Her son, as he advanced in age, entered on the most dissolute courses, by which his life was terminated in the sixteenth year of his age. His mother, who assumed the power, was speedily assassinated by a husband she had chosen to be a sharer of the throne.

The imperial court was eager to take advantage of the unsettled state of Italy to reduce it again under subjection. Belisarius, the most renowned of the generals, was despatched, but with an inconsiderable force. Hostilities raged with great fury, and after a variety of changes in the aspect of affairs, the imperial commander had so weakened the Goths, and so engaged the confidence and assistance of the Italian inhabitants, that the prospect of complete subjugation presented itself. This was, however, clouded by the dissensions which broke out amongst the officers in command of the several divisions of the army of Justinian in 538. At that time the chief command was conferred on Narses, a eunuch, whose conduct at that period, whatever military merit he afterwards displayed, tended greatly to the injury of his sovereign's party.

Narses was indeed soon recalled, and Belisarius reinstated in the supreme command; but in the midst of discord the Goths had been permitted to breathe, an important season was lost, Milan had been destroyed, and the northern provinces of Italy were afflicted by an inundation of the Franks. Under Belisarius the events of the war underwent a favourable change; he captured the strongly fortified city of Ravenna, and returned with numerous captives to Constantinople to receive the applause of the people and a splendid triumph, the last reward of his valour and his humanity.

The removal of Belisarius from Italy revived the spirits of the remaining Goths, and the feeble efforts of the successive generals of Justinian were insufficient to crush the civil war. The handful of the barbarians, scarcely amounting to five thousand, and in possession of no other strong place than Pavia, chose Totila for their chief, and proclaimed him king of Italy, in the year 541.

His progress was rapid, and almost without interruption, from the north of Italy to Naples. He captured that city, and returned to Rome, which he besieged; and though Belisarius, who had been recalled from the wars of Persia, attempted to relieve it, he was unable to do so; and the citizens, compelled by famine, allowed the Goths to occupy the capital of the western empire in the year 546. After an useless occupation of Rome when it had been abandoned by Totila, Belisarius was recalled to Constantinople, and the command once more conferred upon Narses, who was furnished with troops, stores, and money, with a profusion widely different from the parsimony exercised towards his predecessor. He advanced with his forces by the head of the Adriatic Sea, and in a tremendous battle encountered the Goths under Totila, whom he totally defeated, whilst that chief was killed in the conflict. After his death, those who had escaped elected Tejas as their king; but he too became the victim of his ambition, was soon subdued by Narses, and with him terminated, in 553, the Gothic kingdom of Italy, by the capture of the last of their fortified places.

Italy, after these events, became once more a province of the Roman empire, of which Ravenna formed the capital, and in which the representatives of the emperor, the exarchs, fixed their residence. Narses, the first of them, was removed by the jealousy of the Byzantine court; and his successors neglected the defence of the Alpine passes, by which the Longobards, or Lombards, a German race, entered the country. They are supposed to have been of Scandinavian origin, and to have gained a settlement between the Oder and the Elbe in the reign of Augustus. They gradually descended towards the south, and approached the Danube. At the solicitation of Justinian, they passed that river, to reduce, in pursuance of a treaty, the cities of Noricum and the fortresses of Pannonia; but the spirit of rapine soon tempted them beyond these limits, and at length, under Alboin, in 568, they penetrated into Italy.

Before the Lombards entered Italy, they were established on the frontiers of the Roman empire, and had for neighbours two other barbarous tribes, the Avars and the Gepidæ, who were sometimes hostile towards each other, though commonly at peace, demanding and receiving what they deemed tribute, but what the imperialists in their weak state denominated presents. The Avars and the Lombards, at the instigation or with the connivance of the Emperor Justin, the successor of Justinian, jointly attacked the Gepidæ. The bravest of them fell in battle; their king Cunimund was slain, and his daughter Rosamund became the captive of Alboin, the chief of the Lombards, and by marriage shared that throne which had before been occupied by the daughter of Clovis, the king of the Franks.

The ambition of Alboin was excited rather than satisfied by the conquest of the Gepidæ, and the submission of the Avars to his authority; and he turned his eyes from the Danube to the richer banks of the Po and the Tiber. Fifteen years before, his subjects, as the confederates of Narses, had visited Italy; the mountains, the rivers, and the highways, were familiar to their memory. The report of their success, and the views of the spoil, kindled in the rising generation the flame of emulation and of enterprise. Their hopes were encouraged by the spirit and eloquence of their leader. No sooner had Alboin, or Alboinus, erected his standard, than the native strength of the Lombards was multiplied by the adventurous youth of Germany and Scythia. The robust peasantry of Noricum and Pannonia resumed the manners of barbarians; and the names of the Gepidæ, as well as of the Bulgarians, the Sarmatians, and the Sueves, are now to be found in the provinces of Italy. It has been said that Narses the eunuch, to resent an affront offered him by the Empress Sophia, the wife of Justin, had instigated Alboin to the attempt, and counselled him to form an alliance with the Huns before he commenced his operations.

The whole nation of the Lombards, accompanied by their allies, and attended by their wives, their children, their cattle, and their most valuable effects, began their march in April 568. They had no opposition to encounter as they passed through the Venetian country, and the city of Aquileia opened its gates, most of the inhabitants having abandoned their homes at the approach of the formidable invaders. Alboin passed the winter in Friuli, with his troops quartered around him, which city he erected into a dukedom, and appointed his nephew Gisulphus to govern and watch over the territory. In the succeeding year the conqueror advanced and occupied Trevigio, Oderzo, Vicenza, Verona, and Trent, leaving in each city a garrison, and intrusting the whole to one of his officers, with the title of duke during his command. Padua and some other cities were passed by, either because they did not intercept his progress, or because they were too strongly garrisoned. In the third campaign Alboin passed into Northern Liguria, and possessed himself of Brescia, Bergamo, Lodi, and Como, with little opposition, the inhabitants having escaped to the mountains. Milan, then the capital of Liguria, was captured after a short siege, the principal people, with their bishop, Honoratus, having fled to Genoa. In Milan the ceremony of the inauguration was solemnly performed. Alboin was lifted on a shield in the midst of his troops, received the emblems of royalty then in use, and was proclaimed king of Italy.

From Milan Alboin sent out expeditions, which reduced Piacenza, Parma, and Modena, and the other inland cities in Æmilia and Tuscany. At Pavia he met an obstinate resistance, but, after a siege which endured more than three years, that city at length surrendered; and being strongly fortified, it was fixed as his place of residence, and long continued to be the capital of the Lombard kingdom. Whilst Alboin was in Pavia taking the steps necessary to defend the dominions he had acquired, and to reconcile his new subjects to his rule, he was murdered at the instigation of his wife, in the palace at Pavia, in the year 575. The queen, with her paramour, made an attempt to obtain the command of the Lombards; but not succeeding in their purpose, they fled to the Roman garrison at Ravenna, where both perished most miserably. Clephis, a relation of Alboin, having been raised to the throne, extended the Lombard power to the gates of Rome; but he conducted himself with such cruelty, that he was killed by his own people, after a reign of less than a year. His actions produced a dislike to monarchical power, and for ten years no king was chosen. The dukes who had been created among the chiefs of the Lombards acted in their respective territories as independent but allied sovereigns. Under this kind of government their power continued to extend, and that of the emperor gradually retreated before it. The want of a central authority was, however, soon discovered; and, in 586, Autharis, the son of Clephis, was chosen as king, and, by his valour and prudence, established the throne so securely, that it continued to flourish through the two succeeding centuries. It is not necessary to enter into a minute history of the several kings of Lombardy who ascended the throne of that country. A kind of aristocratic monarchy was created, composed of thirty principalities, the chiefs of which were distinguished by the titles of dukes, counts, or barons, which, with the revenues of the land, were held as fiefs under the kings, and became gradually hereditary. The islands of the Adriatic were formed into a republic, and the inhabitants, by electing, in 697, their first doge or duke, formed an independent and central government. The exarch appointed by the government at Constantinople held authority at the city of Ravenna, and had under his power Romagna, the Pentapolis, or five maritime cities of Rimini, Pesaro, Fano, Senigaglia, and Ancona, and almost the whole sea-shores of Lower Italy, where Amalfi and Gæta had their own dukes of the Greek nation. The island of Sicily, and the capital, Rome, in which a patrician ruled in the name of the emperor, formed also parts of the imperial dominions.

Constantly pressed upon by the Lombards, the power and influence of Constantinople gradually declined; and its fall was hastened by the Emperor Leo, called the Isaurian, whose zeal in the destruction of images embittered the clergy of the orthodox church in Italy. The inhabitants of cities forcibly expelled the imperial authorities, and elected a senate, with consuls, as in the time of the Roman republic. In Rome itself a certain power was acknowledged in the bishop, which, on account of the sanctity of his character, was of a paternal nature; at first it was exercised in ecclesiastical affairs, but by degrees extended to civil matters, and in process of time arrived at temporal sovereignty. The popes, who were anxious to defend their territory against the Lombards, when the Byzantine court had neglected or abandoned them, applied for assistance to the Franks.

It may not be improper here to remark, that the original Lombard invaders, composed as they were of various tribes, comprised different religions, some of them still adhering to the ancient heathenism, either of the Greek or the Gothic description; whilst others had embraced the Christian religion, but with the heretical tenets of Arianism. These tribes, with little attention or little adherence to any doctrinal points, had gradually been led to embrace the profession of the Roman Catholic church. Luitprand, who ascended the throne of Lombardy in 711, was the last of that nation to abandon his heresies, which he did in the presence of Pope Gregory at Rome in 729; upon which the pontiff made a public renunciation of his allegiance to the imperial court, and withdrew all claim of obedience from it. Gregory was, however, indisposed to form an alliance with Luitprand, whose vicinity to the capital of his diocese he viewed with suspicion. When the emperor was making preparations to invade Italy, in order to enforce his decrees for the destruction of images, the pope addressed himself to the Frankish monarch, then one of the most powerful princes of western Europe.

The Franks were at that time governed by the celebrated Charles Martel, who had highly distinguished himself in war, and was considered as the best commander of his time. Gregory despatched an embassy to his residence, with numerous presents of holy relics. It was received with respectful distinction, and a treaty was speedily concluded, by which Charles engaged to march with an army into Italy in defence of Rome and of the church, in case any attack should be made by the emperor or the king of Lombardy. The Romans, on their part, were to acknowledge Charles as their protector, and to confer upon him the dignity of the consulship.

Leo the Isaurian was succeeded by his son Constantine surnamed Copronymus, who carried his rage against images to a greater extent than his predecessor, and forbade the worship of the saints and of the Virgin Mary. This occasioned new disturbances in Italy, and made the Romans more zealous than before to separate themselves from their dependence on Constantinople. Zachary, who had succeeded to the chair of St Peter, urged on Luitprand the restoration of the four cities, and also the district of Sabina, which had been seized upon thirty years before; and in compliance with the representation, they were thus added to the sacred patrimony. Luitprand died in 743, after a reign of thirty-two years. His son Rachis, who succeeded him, was anxious to extend his dominions, and invaded the territory ceded to the holy see by his father, when Pope Zachary visited him, and, by his representation of the punishment hereafter to be inflicted on those who violated the rights of the church, so operated upon his mind, that he not only restored the towns and territory he had seized, but took the habit of a monk, and entered into the monastery of Monte Cassino, where he passed the remainder of his days, honoured as a saint by the other monks of the fraternity.

Astulphus succeeded his father on the Lombard throne in 751. The exarchate of Ravenna and the duchy of Rome excited his love for conquest. The city, the capital of the first, was surrendered with little difficulty. He advanced towards Rome, and, when arrived at Narni, sent an embassy to the pope, announcing his determination to enter that city, to seize the wealth of the Romans, and to impose a tax of a golden solidus on every one who would not swear allegiance to the Lombard throne. Stephen, who then filled the papal chair, attempted by negotiation to avert the threatened storm; but failing to appease Astulphus, in imitation of his predecessor, he had recourse to the assistance of France. Pepin, the son of Charles Martel, now filled the throne of that kingdom, and professed unlimited obedience to the holy see. Stephen, by the consent, or at least connivance, of Astulphus, whose forces were encamped round the city of Rome, made a journey to France, and Pepin immediately, accompanied by the pope, passed the Alps with a large army, and advanced into Italy. Astulphus could not raise a sufficient force to repulse his assailants, and, after some slight reverses, retired to Pavia. In that city he was besieged, and compelled to sue for peace. This was granted, upon the condition that he should give up, not to the emperor, but to the pope, the several cities he had captured in the exarchate and the dukedom, and deliver hostages for the performance of the conditions agreed on. Pepin with his forces returned to France; and the pope proceeded with exultation to the south, in the expectation of being placed in possession of the cities and territories which Astulphus had stipulated to deliver up, and which Pepin had guaranteed to the holy see. The Lombard king, however, as soon as the storm had passed over, broke into the dukedom and besieged Rome. The pope again had recourse to Pepin, who readily advanced. Astulphus, after an unavailing siege of three months, abandoned Rome, and once more took refuge in the strong fortifications of Pavia. During this second siege, which Pepin speedily commenced, an embassy from the Emperor Constantine Copronymus arrived at his camp, to remonstrate against the donation of the exarchate to the pope; and offered to repay the expenses of the war to France, if the territories were delivered over to the power of the emperor. Pepin replied to the envoys, that "as he had a right to those territories by the sword, and had thought proper to bestow them on the pope, nothing should induce him to alter his resolution." By a vigorous prosecution of the war, Pepin obtained a peace; and for the pope the city of Commachio, in addition to what had been before ceded to him. From this period, 756, the pontiffs assumed the language as well as the power of sovereigns, no longer using for the dates of their rescripts the year of the reign of the emperor, but that of their own pontificates.

Astulphus, soon after executing the treaty concluded at Pavia, met an untimely death, the manner of which, however, has been variously described. During the succeeding twenty years the Lombards languished in a state of weakness and decay, but interrupted by a disputed succession, which ended in the elevation of Desiderius to the vacant throne. A double marriage was arranged between two daughters of this Lombard king and Carloman and Charles (usually called Charlemagne), the sons of Pepin. Charles soon divorced his wife, under the pretence of barrenness; and Carloman died, leaving two sons, the grandsons of Desiderius, who detained them in the hope that they might be made use of to produce disturbances in France. Thus family jealousy was one amongst many grounds of quarrel. Desiderius was induced to attack the dominions granted to the pope; and, at the invitation of the pontiff, Charlemagne advanced with a large army. Desiderius, like his father, took refuge in Pavia; and after the capture of Verona, and a visit to Rome, Charlemagne drew up his forces, a part of which had blockaded it, around that city. The defence was brave and protracted; but by famine, and by the plague, which raged within the walls, the city was at length compelled to surrender. Desiderius being thus made prisoner, and sent with his family to France, all the other cities submitted to Charlemagne in 774. That monarch claimed the kingdom of the Lombards by right of conquest, and caused himself to be crowned king, with an iron crown, by the hands of the Archbishop of Milan, in the presence of his army, at a place called Modastia, about twelve miles from that city.

Thus ended the kingdom of Lombardy, after it had existed two hundred and six years. Though the Lombard kings were at first rude and barbarous, yet, when they had embraced the Christian religion, they ruled with great equity and mildness. "Under their government," says Paulus Diaconus, "no violence was committed, no one unjustly dispossessed of his property, none oppressed with taxes; theft, robberies, murder, and adultery, were seldom heard of, and every one went whither he pleased. They were the only power in Italy capable of defeating the ambitious views of the bishops of Rome, and hence arose the inveterate hatred which the popes bore to them; but their many wholesome laws, which are still extant, are at the same time convincing proofs of their justice, humanity, and wisdom, and a full confutation, as Grotius observes, of the many calumnies with which the popes and their partisans have endeavoured to asperse them."

The conduct of Charlemagne to his newly-acquired kingdom appears to have been wise and liberal. He sanctioned the laws by which the districts had been governed, whether Roman or Lombard; but to the latter he made a few additions. The emperor was left in quiet possession of the dukedom of Naples, and of the other places in Italy that he held. He allowed to the Dukes of Spoleto, Friuli, and Benevento, the same power and authority as they had exercised under the Lombard kings; and the smaller dukes were continued in their dignities, but were compelled to take annually the oaths of allegiance to him; and, unless they violated it, the dignity was made hereditary in their families. Having thus settled the affairs of Italy, he returned to France, having, in 781, appointed his son Pepin his viceroy.

A seditious controversy in Rome, respecting the election of a pope, induced Leo III. who had been raised to that dignity, to pass the Alps and apply for protection to Charlemagne, against the Roman populace. The conqueror of Italy, in consequence of this, repaired to Rome, where, on Christmas day 800, during the celebration of divine rites, Leo suddenly placed a valuable crown on his head, and the church resounded with the acclamations of the people, "Long life and victory to Charles, the most pious Augustus, crowned by God, the great and pacific emperor of the Romans." The title thus conferred by the pretended sudden impulse of a pope, on a conqueror who denied all participation in the project, has been retained by his German successors, till it was abandoned in the present century, out of compliment to revolutionary France.

A. D. 774 to 961.

During the life of Charlemagne, whilst his son Pepin was acting as viceroy, Venice, which had grown up to be a consolidated and warlike power, disavowed the title conferred by the pope, and commenced hostilities against his Italian dominions. The Saracens, a new power, availed themselves of the circumstances, and attacked the islands of Corsica and Sardinia, where they obtained much plunder, and made many of the inhabitants captives. Pepin equipped an army and a fleet to reduce Venice to submission; but having failed in the attempt, and lost most of his vessels among the shoals and rocks of the islands, chagrin at the reverses he sustained caused his death, which took place soon afterwards at Milan. A natural son of Pepin, named Bernard, was nominated by Charlemagne as his viceroy in Italy.

Charlemagne died in 813, and was succeeded by his son Louis. Louis and Bernard met at Aix-la-Chapelle, and appeared to have arranged the mode of ruling the extensive dominions of their departed ancestor; but the ambition of Bernard led him to attack his uncle, and to dispute his succession. Louis, however, was enabled to baffle his aspiring nephew, who was defeated, captured, and condemned to the loss of sight, under which operation he expired, in the fifth year of his reign.

Italy remained as a portion of the Frankish monarchy till the treaty of Verdun in 843, when it was delivered over, with the imperial title, and with the addition of the country of Lorraine, to Lotharius I. the eldest son of Louis. He bequeathed his dominion to Louis II. in 850, who appears to have been the best of the princes of the Carlovignian race. He died, after a prosperous but rather a turbulent reign, in 875. The election of a pope, Benedict III. his rejection by Louis, and the ultimate submission of the monarch to its legality, were sources of vexation, though not of actual hostility. In the latter years of his reign, the Saracens, instigated by the emperor, invaded the south of Italy; but having been defeated near Capua, they were expelled the country. Three years afterwards they again resumed their attacks, and besieged Salerno; but meeting with a severe repulse, they again departed, leaving Italy at peace at the time of the death of the monarch.

His death seemed the signal for discord, from the va-

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rious claimants in the imperial family to the Italian dominions. Charles the Bald of France first took possession; but dying in 877, Carloman, king of Bavaria, seized the inheritance; and he was followed in 880 by his brother Charles the Fat, king of Suabia, who, for the last time, united under one sovereign the whole of the Frankish monarchy. During seven years Italy was the theatre of lawless violence, in which the nobles required an Italian prince, and the pope was anxious to have a foreigner placed on the throne; whilst the Saracens, availing themselves of the disturbances, extorted money from the pope as the price of peace, and still continued their depredations. Berengar duke of Friuli, and Guido duke of Spoleto, with the Marquis of Ivrea, were rivals for the throne; but Guido was, in 894, crowned as emperor and king, and his son Lambert nominated as his successor in these dignities. Arnulf, the German king of the Carlovignian race, urged and succeeded in his pretensions, and was crowned in 896; but, like those who succeeded him, he was unable to exercise any considerable power except whilst he continued to reside among his subjects.

After the death of Lambert in 898, and of Arnulf in 899, Louis, king of Lower Burgundy, appeared as the rival of Berengar I., but without effect; and the same fate befell another claimant, Rudolph of Upper Burgundy; in spite of the pretensions of both, the possession of the throne was at length, in 915, in the hands of Berengar, who was solemnly crowned. The power in the hands of the feudal vassals of the throne was so much weakened by the recent dissensions, that it became almost impossible to repress the plundering inroads which the Saracens were continually making on his dominions. This monarch was murdered in 924, when Rudolph of Upper Burgundy was induced to transfer his pretensions to the throne to Hugo, count of Provence. Hugo endavoured, by the exercise of the most bloody tyranny, to gain the unsteady dominion of Italy; but his nephew Berengar, marquis of Ivrea, having escaped some snares that were laid for him, fled for refuge to Otho the Great, in Germany, collected there a number of fugitives, turned towards Italy, and in 945 succeeded in compelling Hugo to abdicate the throne, and transfer it to his son Lotharius, who was less the object of general aversion than himself, and who, upon his accession, appointed Berengar his first minister of state.

The death of Lotharius occurred in 950, and was supposed to have been the result of poison administered by Berengar, who was desirous to force the beautiful wife of the former to unite with his son. To avoid this match, and to escape from the consequences of rejecting it, she fled for safety to the city of Canosa, against which her persecutor commenced a siege. She then applied for assistance to King Otho. He with great expedition passed the Alps, liberated the lady, defeated Berengar, captured Pavia, and having seated himself on the throne of Italy, espoused the fair Adelheld in 951. Berengar made himself useful to the new sovereign by his early submission, and by his delivering up the Friouls, the keys of Italy, to the brother of Otho; and thence his offers of service were accepted, and he was appointed to rule the country in the name of Otho. After ten years, complaints reached the throne from the great vassals in Italy, when Otho returned there, dismissed Berengar from his station, led him as a prisoner to Bamberg in Germany, and having united Italy with his German dominions, was crowned with the iron crown at Milan in the year 961. Otho certainly granted the best lands as feuds to his German nobles; but he conferred great privileges on the cities of Italy, and on these were grounded free constitutions, which, however, soon converted the country into a theatre of anarchy. During the tenth century, the liberality of the Frankish kings, who had served their purpose, so corrupted the church, and so weakened the royal authority, that it effectively undermined it; whilst the clergy and the people elected the popes according to the dictation of the consuls and of the inferior patricians. Thus it happened that, in the first half of the tenth century, two eminent intriguing females disposed of the holy see. Theodora, in 914, raised her son by her lover Pope John X., to the chair of St Peter, which he filled under the name of John XI. The brother of the last, Alberich of Camerino, and his son Octavian, were absolute masters of Rome; and the latter was consecrated pope in 956, at the age of twenty years. Otho, when crowned at Rome in 962, annulled the election, and appointed Leo VIII. in his stead; but the people, jealous of this exercise of power, elected Benedict V. The popes, instead of governing Rome, were thus themselves dependent on the leaders of the populace.

The republics of Gaeta and Amalfi, in the Neapolitan part of Italy, still maintained their independence against the Lombard dukedom of Benevento. This was more easily defended, from a division having been made of the territory of the dukedom, which diminished its power, and because they had a common enemy to contend with in the Saracens, who had by each party been invited to afford them assistance in their quarrels, but who had fixed themselves in Apulia, and there constructed powerful fortifications. The Emperor Louis II. and King Macedo, by their united forces, had so broken the power of the Mussulmans in 866, that the latter could no longer maintain themselves in Lower Italy; and thus enabled the Greeks to form establishments on the territory previously occupied by the Saracens. They founded a province, called the Thema of Lombardy, which was ruled by a chief residing in Bari, and which maintained its independence during more than a hundred years.

Otho the Great was succeeded, in 973, by his son Otho II. Under his reign Crescentius, then consul in Rome, on the pretence of restoring the ancient constitution, attempted to secure to himself the sole power of that city; whilst Otho was occupied in carrying on some plans of conquest in Lower Italy, and suffered the vicious popes, Boniface VII. and John XV. to exercise supreme authority. But, in 983, Otho III. succeeded his father, and elevated his cousin Gregory V. to the papal throne, when Crescentius, with the assistance of the populace, was enabled to drive him from the city, and to fill his station with a Greek pope, John XVI.; and he attempted also to lead back the Romans to an apparent subjection to the Greek emperor. Otho soon replaced Pope Gregory in the papal chair by force, and besieged Crescentius in the Castle of St Angelo, where he was at length, with twelve others of his associates, made prisoner, and, along with them, suffered decapitation in 998. Though compelled to take the oaths of allegiance, the submission of the city was reluctant, and the disposition to throw it off was only repressed by force of arms.

A. D. 961 to 1073.

The death of Otho III. in 1002 was deemed by the Italians a dissolution of their connection with the German emperors, and Hardouin, marquis of Ivrea, was crowned king of Italy in Pavia; upon which the jealousy of the Milanese, the habitual rivals and enemies of Pavia, induced the citizens of that place to declare Henry II. of Germany as king also. The immediate consequence was a civil war, in which each city and district took a greater or a less part, and all suffered most severely. Henry was indeed, in 1004, acknowledged by the assembly of nobles collected in Pavia; but, in the tumult which arose on the occasion, a great part of the city was destroyed by fire.

After the death of Hardouin in 1015, Henry was acknowledged as king by the whole of Lombardy; as was also, after his death, his son Conrad II. who was, however, known in Italy as Italus or Italicus I. A general assembly was held near Piacenza, at which all the power of the feudatories was declared to be hereditary by an irreversible law, and zealous attempts were made to obtain peace and security to all the states. These efforts were ineffectual, from the rage between the growing cities and their bishops, as well as the hatred between the clergy and the nobles, and between those bodies and the inferior inhabitants. In republican Rome, where the family of Crescentius still directed the voices of the public, neither Henry, nor Conrad, nor the pope, could enforce obedience. When Henry III. the son of Conrad, came to Italy in 1046, he found no less than three popes in Rome. These he displaced, and selected, by his sole power, Clement II. who was placed in the chair of St Peter; and regularly afterwards raised to the spiritual dignities respectable German ecclesiastics. This reform, although apparently wise at the time, as giving dignity to the pontiffs, was afterwards found in practice to have tended to corrupt them.

During the long minority of Henry IV. after the death of his father, Hildebrand, a monk, afterwards Pope Gregory VII. took the lead in opposition to the temporal power, and increased that of the ecclesiastical to an alarming extent. This increase of clerical power was much promoted by the transactions of the Normans. As early as the year 1016, some warriors from Normandy settled in Apulia and Calabria, and having early formed alliances with the Lombards, the republics, or the Greeks, as best served their purpose, against the Saracens, they became, through their warlike habits, a very powerful party. Leo IX. made several attempts to draw them away; but these all failed, and ended in his own captivity and submission. Nicholas II. on the other hand, formed alliances with the Norman leaders, and in 1059 endowed Robert Guiscard with the feudal rights of all the lands he had conquered in Lower Italy. Afterwards, the popes, in the contentions with the imperial power, trusted chiefly to the aid they could draw from their faithful confederates, the newly-created Dukes of Apulia and Calabria, to whom were afterwards added the chiefs of the Normans in the island of Sicily. Whilst, in the south of Italy, the small states thus became larger, in the north the great states were broken up into several of small extent and power. The Lombard states founded their subsequent greatness, and Venice, Genoa, and Pisa had already become rich and powerful. The Pisans, who, in 980, were in alliance with Otho II. and performed great services against the Greeks, and against the Saracens in Lower Italy, united with the Genoese, now a seafaring and warlike people, to attack the unbelievers in Sardinia, and twice, in 1017 and 1050, conquered those intruders, and finally divided the lands, in large districts, amongst the most eminent of the native inhabitants.

A. D. 1073 to 1100. Gregory VII., usually called Gregory the Great, was at the head of the church, using all the exertions and influence of his station to extend its power. He laid claims to authority over Spain as a fief of the church, and required of that kingdom all the conquests which had been made from the Moors. Sardinia was demanded of the conquerors, and France was under his authority. He made attempts to exercise his power in Hungary, and even in Russia; and extorted from England the tax known by the name of Peter's pence, which long continued to be paid. In Italy, where knowledge had begun to dawn, there were many opposed to the vast extension of the papal power; but they were outnumbered by others, who feared more the government of a German prince. In most of the other parts of Europe the regular priests had so much influence, that the monstrous pretensions of the pontiff were submitted to with little or no reluctance. It was not so, however, in Germany. The policy of Gregory had enjoined on the priests the observance of celibacy, and the German clergy were reluctant to put away their wives. They opposed the pope's decrees, and joined with the emperor in resisting them. The German bishops in council pronounced the deposition of the pope; and the pontiff issued his excommunications against them and their emperor. A war thus broke out between Henry of Suabia and Pope Gregory, though Clement III. had been created pope by the Germans. Gregory and his army was defeated, and he retired to the Castle of Angelo, where he was long besieged, and at length, being released by Robert the Norman, removed to Salerno, where he died in the year 1085. Two popes were chosen in succession by the cardinals, viz. Victor III. and Urban II.; whilst the antipope Clement, with his conclave, sometimes in Rome, at other times driven from it, never ceased to fulminate his excommunications. Urban maintained the contest with Clement, and in fact triumphed over him. His success was owing in a great measure to the part he took in favour of the Crusades, which about that period began to excite the attention and rouse the passions of all Europe to achieve the conquest of the Holy Land. The enthusiasm of the period enabled Urban to drive Clement from the city of Rome, and to take possession of the chair of St Peter, in which dignity he terminated his life in the year 1099. Paschal II. was fixed by the cardinals at Rome in the papal chair; and though the party of Clement on his death elected another antipope, it did not weaken the secure hold on the dignity to which Paschal had been elevated. The son of Henry IV. was encouraged by the pope to rebel against him, as one who, being excommunicated, could not convey to his successor any right. The father was made prisoner by the son, and Henry V. was then crowned emperor and king.

Henry V., though, until he obtained the throne, the devoted defender of the papal claims, after his accession became their antagonist, and thus gained the support of his German nobles. After suppressing commotions in other parts of his dominions, he crossed the Alps with an army of eighty thousand men; passed through Italy to Rome without serious opposition; and there massacred many of the citizens, shut up the pope, the cardinals, and the nobility in prison, and held them confined till he had obtained from the pontiff the full investiture of all his dominions. The pope then crowned him as emperor, and honoured him at his departure with every mark of respect. Henry had scarcely reached his patrimonial dominions when he found a general flame kindled around him. The Lateran council disavowed all that his holiness had done, upon the notorious ground that it had been extorted by force. The French clergy had acquiesced in the excommunication, and those of Germany rejected the bull of investiture; whilst a rebellion, excited by Duke Lothario, broke out in Saxony. By the aid of the Duke of Stauffen-Suabia, Henry was enabled to lull the domestic threatening storm, and again with an army marched to Italy, and seized upon Rome, whilst the pope fled to Apulia. He was once more crowned, the ceremony being performed by the Archbishop of Braga, in Portugal, on the assumption that the former coronation had been invalid, from the perjury of the pope who had performed the ceremony. At the conclusion of his reign Henry V. had nearly lost his influence in Rome, so that he had, at least tacitly, given up all concern in the election of a pope, when Calixtus was chosen by one party, and Honorius II. by another, to fill that dignity. Shortly afterwards he died at Utrecht in May 1125.

During the reigns of these German princes many of the cities of Italy had risen to considerable wealth, power, and splendour, and, from the emperors being often absent with their armies in the other parts of their dominions, had assumed to themselves almost all the rights of sovereignty.

These cities forced the others of less extent near to them into an alliance, by which they obtained the aid of their population whenever they had occasion to have recourse to arms. The two cities of Milan and Pavia, in the north of Italy, were the chiefs of rival associations. Disputes between Milan and Cremona gave occasion to the first hostilities between the former of those cities and Pavia, in 1129, to which a contest between two rivals for the crown of Italy, Lothario II. and Conrad of Hohenstauffen, gave a different direction, and created two parties, the Guelphs, the adherents of the popes, and the Ghibelines, the supporters of the German emperors. These two parties, which long divided Italy, derive their origin from a family which in the eleventh century held extensive possessions in the north of Italy, amongst the mountains between St Gothard and the Brenner, and bore the name of Welf. They descended into the plains of Germany, and obtaining settlements in some of its finest provinces in the south of that country, this enabled them in process of time to become the founders of both the royal and ducal houses of Guelph; the first seated on the throne of Great Britain, and the second enjoying the duchy of Brunswick.

This family quarrelled among themselves, one branch bearing the name of Welf, changed by the Italians into Guelph, and the other Waiblingen, changed into Ghibeline; and they had, before their intermeddling in the Italian wars, fought a bloody battle at Winsberg in 1140. The state of Italy favoured the creation of parties, to which the chiefs of the two branches of this German family attached themselves, and continued their animosity during more than one hundred years.

In Rome were violent schisms between the partisans of rival popes; and this again gave rise to that spirit of independence which that city had constantly nourished. It was especially excited by the preaching of Arnold of Brescia, an eloquent monk, the pupil of Abelard, who declaimed with great energy against the luxury of the clergy, and in favour of that liberty which Rome had in ancient times enjoyed. Though banished in the year 1146, he returned again from Zurich, where he had taken refuge, and, under Pope Adrian IV. was condemned and executed in 1155. In the mean time the two great cities had strengthened themselves. Milan had in her alliance the cities of Tortona, Crema, Bergamo, Brescia, Placentia, and Parma. Pavia was at the head of Cremona and Novara. Verona, Padua, Vicenza, Treviso, and Mantua, who were nearly equal in power, maintained each its independence. Turin was at the head of the towns of Piedmont, and disputed the authority of the Counts of Savoy. The great feudatories were the Marquis of Montserrat and the Prince of Asti. To the south of the Po the city of Bologna had acquired great power, and exercised influence over Modena and Reggio on one side, and Ferrara, Ravenna, Faenza, Forli, and Rimini on the other. Florence had risen to superiority in Tuscany by the destruction of Fiesole, and had as allies the cities of Pistoja, Arrezzo, San Minato, Volterra, Lucca, Cortona, Perugia, and Sienna.

Such was the state of affairs in Italy when the diet of the empire of Germany, assembled at Frankfort in the year 1152, bestowed the crown of that kingdom on Frederick duke of Bavaria, of the house of Hohenstauffen, better known by the name of Barbarossa, the nephew of Conrad, his predecessor in that dignity. The new emperor is recorded by the authorities of his time to have been brave, just, and not addicted to cruelty, yet his reign inflicted the most severe visitations on Italy. The cities were zealous to defend the rights of self-government which they had obtained, and, though filled with factions, resolved to maintain them. They were surrounded with strong walls, impregnable against the arts of attack then practised; and they were well peopled with men, patient, brave, and abstemious, when a siege demanded the exercise of such qualities. The open country and the smaller towns, from which the numerous fortified cities drew their sustenance, suffered severely whenever an army traversed that country; and, to produce a greater pressure on the cities, the rude soldiery of that time not only destroyed the provisions they could not consume, but cut down the growing crops before they were fit to be harvested, or set them on fire, with the houses and the barns of the cultivators. Barbarossa viewed the whole of Italy as his subjects, and treated those who opposed him as rebels and traitors; and as the Ghibelines, who were the weaker party, adhered to him, his chief operations were directed against the Guelphs, of whom Milan was the main support and the centre of union.

Six times did the emperor cross the Alps with a numerous German army to reduce the country to obedience, and each time his attempts were frustrated. In 1154, in conjunction with the city of Pavia, he defeated the Milanese army, but could not take the city; yet he destroyed Tortona, and was then crowned, both in Pavia with the iron crown of Lombardy, and at Rome with the golden crown of the empire, though the ceremony was performed in the suburb, admission within the walls of the latter city being refused. After plundering Spoleto, sickness and desertion so thinned his ranks, that he led back the remnant of his troops, and repassed the Alps by way of Trent and the Tyrol. The most savage destruction was perpetrated in the retreat; but the cities were unassailed, and rejoiced in their freedom, though they did little injury to the retiring army. In the interval that followed, a civil war was carried on by the two parties, at the head of which were Milan and Pavia; but in this the latter, the weaker of the two confederates, suffered the most, whilst by the former the citizens of Tortona were received with sympathy, their houses rebuilt, and their fortifications restored.

Barbarossa entered Italy again in 1158, with the vassals who crowded to him from all parts of Germany. At Brescia, the terror of his name induced that city to renounce the alliance with Milan, which refused to receive the emperor. By the aid of the militia of Cremona and Pavia he was enabled to besiege Milan; but his engines being insufficient to beat down the walls, he resolved to starve it into surrender, and intercepted all provisions and destroyed the growing crops. In this situation of distress, Blandrate, an independent noble, known as a protector of Lombardy, with some others of the same rank, assumed the office of mediator, and obtained favourable terms. The city agreed to pay a tribute, and to restore the rights of the emperor, on condition that they should elect their consuls, and not be bound to open their gates to the emperor. Tortona and Crema were both included in this pacification, which was signed on the 7th of September 1158. A few weeks afterwards, a diet of the kingdom of Italy having been convoked at Roncaglia, fixed much wider bounds to the regal rights than the Milanese would admit, upon which they again took up arms and prepared to defend themselves. Another diet was called, which met at Bologna in the spring of 1159, and by whose decision Milan was declared to be under the ban of the empire. As that city was too strong to be captured, the first attempt of the emperor was directed against the allied city of Crema, which was compelled to surrender, after a siege of six months, in January 1160.

The German troops were exhausted by the severe duty of the siege, and their term of service having expired, many of them withdrew; but Frederick, with the Italian Ghibeline cities of Pavia, Cremona, and Novara, carried on the war by devastating the country of the Guelphs, and excluding all supplies from Milan. In June 1161, a new army reached the theatre of war in Italy, when the emperor resolved to reduce what he called his rebellious city. The defence of Milan was hopeless, but firmly maintained, when a fire, which destroyed the chief magazine of provisions, induced the inhabitants to surrender at discretion in March 1162. Frederick, though proud and severe, was not cruel, and never put to death by the hands of the executioner either enemies or rebels when vanquished. He ordered the militia of the Ghibeline cities to raze the walls, and so to destroy the buildings, that not one stone should be left on another. The poorer inhabitants were placed in villages at some distance from the place; and many sought hospitality in other cities, where their perseverance was recorded with applause, and where they spread the love of freedom and hatred of tyranny. The spirit of independence so rapidly increased that it was soon communicated to the Ghibeline cities; and the effect of it was to produce a confederacy of a most extended nature. Frederick had entered Italy in 1163, attended only by his splendid train of nobles, but without an army, under the impression that he could at pleasure call out the militia of the Ghibeline cities. He directed his steps towards Rome, where, on account of a contest for the papal chair, occasioned by the death of Adrian IV., he thought his presence necessary. Whilst in the south, a union was formed in the Veronese, which he deemed injurious to his prerogatives; and he hastened to call out the militia of the Ghibeline cities of Pavia, Cremona, Lodi, and Como, to lead them against Verona; but they were indisposed to the service, upon which he returned to Germany to collect an army, on whose exertions he might depend.

In October 1176 Frederick descended from the Grisons with his newly-collected army. His military operations were ineffectual; and whilst he advanced to Rome and to Ancona, the confederation of the cities of the Guelphs and the Ghibelines was cemented, and assumed the name of the League of Lombardy. Frederick had been repulsed at Ancona, whilst he had been victorious at Rome; but his victory proved useless. His army was attacked by disease, which swept away great numbers; and with the remnant he could scarcely protect himself from the increasing influence of the League, whose authority had already restored Milan, and built the new city of Alessandria, at the confluence of the rivers Tanaro and Bormida. In March 1168, the emperor, with but a very few troops, was enabled to effect his retreat from his Italian subjects, by the road of Mount Cenis, and soon prepared a new German force, which was to be employed in coercing them.

In the efforts to lead the Germans again into Italy, he was baffled by their reluctance, and remained, as far as regarded Italy, in a state of repose during five years. He sent, indeed, his warlike chancellor, Christian, archbishop of Mentz, to raise his party in Tuscany, the only district in which there existed any portion of attachment to the Ghibeline cause.

In October 1174, Frederick again entered Italy at the head of a powerful army, but was detained four months by the siege of the newly-built town of Alessandria; and the sickness among his troops, occasioned by the severity of the winter, so weakened him, that having abandoned the siege in April 1175, he was too weak to attack the forces of the League, and thus induced to enter on a negotiation. Much time was spent, but no plan of conciliation was adopted; and Frederick again sent into Germany for an army, which arrived in the spring of 1176 at Como, whither he was enabled secretly to join them; but he could get very little aid from the few cities of the Ghibeline party. He advanced to the neighbourhood of Milan, and at Lignano attacked the forces of the League. Though at first he met with success, yet the issue of the battle was so decisively against him, that his camp was pillaged, his army dispersed, and himself rendered a fugitive; but finally he escaped to Pavia, to contradict the report of his death, which had prevailed during several days. Negotiations followed this defeat. The pope and the Venetians acted as mediators, and in 1177 a truce for six years was concluded. During its continuance the political power of the League was strengthened and consolidated; whilst, on the other hand, the emperor had learned the lesson, untaught to his predecessors, of submitting to restrictions imposed by subjects on their sovereign. The truce was followed by the treaty of Constance in 1183, which secured the privileges of the cities, and recognised the prerogatives of the monarch, with certain necessary restrictions.

Barbarossa partook of the religious enthusiasm which infected all Europe, and, after the peace of Constance, repaired to the Holy Land, where, in 1190, he died of an apoplectic attack.

Though the peace of 1183 gave political freedom to the cities, yet this not being followed by any confederation, they each thought only of strengthening their defences, and of intriguing for power and supremacy. A party spirit was thus kindled, which spread and continued during the whole period that the emperors of Germany of the house of Hohenstauffen continued to exercise the shadow of sovereignty. The cities were soon divided again into Guelphs and Ghibelines, but had changed their party principles, the Ghibelines being the defenders of the papal power, and the Guelphs the assailants thereof. The party feeling within each of the cities was strong and active. In those where the Guelphs had the government, a large minority constantly opposed them; and the same was the case where the opposite faction had the upper hand. Noble and other families were engaged in long feuds with each other, which endured through generations, and were constantly occasioning open murders or private assassinations. The history of these cities is filled with narratives that exhibit human nature in forms most revolting to our best feelings.

A single, though far from a solitary, instance of the prevalent feudal proceedings, may not be without its use in showing the effects of such a state of society as existed in these cities. A noble Guelph, named Buondelmonte, of the upper vale of the Arno, had demanded the hand of a young lady of the Ghibeline house of Amidei; and his proposals having been accepted, preparations were made for the marriage. But a lady of another family, the Donati, stopped the lover as he passed her door; and bringing him into the apartment where her females were at work, raised the veil of her daughter, whose beauty was most captivating. "Here," said she, "is the wife I had reserved for thee. Like thee, she is a Guelph; whilst thou takest one from the enemies of thy church and race." Buondelmonte, dazzled and enamoured, instantly accepted the proffered hand. The Amidei considered this inconstancy as a deep affront; and all the noble families of Florence of the Ghibeline faction, about twenty-four in number, met, and agreed that he should atone with his life for this offence. Buondelmonte was attacked on the morning of Easter Sunday, as he passed the bridge on horseback, and was there killed. Forty-two families of the Guelphic faction then met, and swore to avenge the insult; and thus blood was shed to atone for blood. Every day some new murder or some open battle alarmed the citizens of Florence, during the space of thirty-three years. These two parties stood opposed to each other within the walls of the same city; and although sometimes in appearance reconciled, yet every little accident renewed their animosity, and they again had recourse to deadly warfare.

The nobility of Italy, who possessed extensive feudal estates in the intervals between the cities, and some in contact with them, were bound by their tenures to take part with the emperor in the hostilities he had carried on

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against the cities. By this they had been much impoverished and in debt; and their creditors were for the most part the inhabitants of the cities, to whom the estates were hypothecated. They were a high-spirited race, had by practice acquired great skill in arms, and were acuter and abler political intriguers than the magistrates of the cities. Some of the nobles, who had castles sufficiently strong, lands sufficiently extensive, and vassals sufficiently numerous, to defend themselves, became attached to the Ghibeline party. Those of them whose castles were weak from their situation, or near to cities too populous to be ruled by them, had been admitted to become citizens of such places, had assisted them in war, had obtained a considerable share in their government, and were for the most part compelled by their interest to become adherents of the Guelphic faction. The plains of Italy were thus deprived of all the independent nobility, who had become citizens of some of the free republics; but every chain of mountains was thickly set with castles, held by those who, whilst they maintained their own independence, professed to owe and to acknowledge allegiance to the emperors. As war was their sole occupation, they were often gladly received by the republics, which stood much in need of able captains. It seems that the independent nobles who became connected with the cities as commanders of the forces were not always, though most commonly, of the same faction; for the Ghibeline family of Visconti, which held most extensive fiefs, associated itself with the Guelphic republic of Milan. These nobles, however, when connected with the cities, soon acquired extensive influence, and became finally founders of families who obtained hereditary, and, some of them, sovereign power. Of these the house of Este, allied to the Guelphs of Saxony and of Bavaria, who had strong castles on the Euganian Hills, joined the republic of Ferrara. The family of Ezzel or Eccelino, whose fiefs and castles were at the foot of the Tyrolean range, and who were devoted to the Ghibeline party, formed connections with the republics of Verona and Vicenza. On the northern side of the Apennines, the fortresses of several Ghibeline nobles excited and maintained revolutions in Placencia, Parma, Reggio, and Modena; whilst on the southern side of those hills were the castles of other Ghibeline nobles, in turn citizens or enemies of the republics of Arezzo, Florence, Pistoja, and Lucca. In the lower valleys of the Po, as well as in the upper vale of the Arno, the castles of the Guelphic nobles supplied leaders to the republics in their vicinity.

The factious and ferocious state of society here briefly sketched continued during the whole of the reign of the family of Hohenstauffen; but it is only justice to observe, that in the latter years of that period the art of painting first made its appearance in Italy, and that the first dawn of the revival of literature became visible in the horizon, by the improvement made in the language, by the discovery of magnifying glasses and of the magnet, by the establishment of the university of Bologna, and by some writers of talent, to whom the literature and civilization of all Europe became deeply indebted.

During the nominal reign of the German family, no one of the individuals who succeeded to the title after the death of Barbarossa is deserving of notice, excepting his grandson, Frederick II., who attained the dignity before he had arrived at the age of eighteen. During his reign, Pope Innocent III. attained the pontifical chair; a man of rare talent, great learning, strict morals, and adequate energy. Though the founder of the mendicant orders of Franciscans and Dominicans, and of the fearful power of the inquisition, and though the instigator of the crusades against the Albigenses in France, all his acts originated in the view he took of the moral effect of the increase of the ecclesiastical power, and of its concentration in the head of the church. He made efforts in Rome to establish civil liberty, by forming a representative senate, to whom all power but the judicial was intrusted; but he issued his commands to all the princes of Europe in stronger tones than those of Gregory the Great, which, if obeyed, would have deprived them of all political liberty.

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Frederick carried on wars, in spite of the pope's anathema, with great success. In 1237 he defeated, at Cortenuovo, his opponents, who lost 10,000 men; and his subsequent activity gained all Upper Italy to his party, except the four cities of Milan, Brescia, Placentia, and Bologna. But Gregory IX., who had succeeded Innocent on the papal throne, induced the maritime republics of Venice and Genoa to rescue the Guelphs from destruction. This gave a turn to affairs, though Pisa still held fast to the emperor and the Ghibelines. A general council, summoned by the pope, pronounced his excommunication, and his party forsook him by degrees. The mendicant orders everywhere excited conspiracies against him; he became suspicious of every one around him, and was at length obliged to concede every thing to the pope; and, through the mediation of St Louis of France, he proposed, as the condition of his re-admission to the church, that he should go to the Holy Land and join the crusaders, engaging never to return. Whilst waiting the effect of his proposals at his castle of Florentino in Sicily, where he still ruled, he was seized with a dysentery, and died in December 1250.

After the death of Frederick, and the triumph of Pope Innocent IV., much confusion ensued, in which all freedom was extinguished. The pontiff was deceived in the expectation of general submission which he had formed. He was, during a progress, in some places received with coldness, and in others with disdain. The populace were in a state not to be restrained; the demagogues who directed could not rule them till they had assumed military and despotic power. In this progress the most unheard-of cruelties were perpetrated. In the single city of Padua there were eight prisons always full, notwithstanding the incessant toil of the executioner to empty them; and two of these prisons contained three hundred prisoners each. The Eccelinos became for a time absolute masters of the north of Italy, and were succeeded by the family of Romano, and they by Marten della Torre. The cities of Mantua and Ferrara fell into the power of D'Este, and Verona into that of Mastino della Scala. Palavicino became lord of Cremona, and in process of time, when the disorders had attained their greatest height, of Milan, Brescia, Alessandria, and Tortona. The whole of Italy, with the exception of Tuscany and the maritime cities, had learned that the rule of an individual was far better than that of a democracy, and quietly submitted themselves to a military commander.

During the period in which the emperors of Germany of the Suabian or Hohenstauffen race were the kings of Italy, the maritime cities of Venice, Genoa, and Pisa, had grown up to be powerful republican states, and were only by slight ties bound to the common sovereigns of Italy. The nobility who had been admitted to the rights of citizenship were the senators; and some member of their families was commonly chosen as a ruler, with the title of doge or duke. They were strict aristocracies, preserved in that form by laws which, whilst they gave security to their privileges, secured in like manner the rights and possessions of each individual. Under this state of security they naturally became wealthy, and their progress was accelerated by favourable circumstances. The Crusades, which animated the whole west of Europe, created a demand for shipping to convey troops and stores to and from the Holy Land; and thus a mercantile navy was called into being, which could at any time be easily A. D. 1260 to 1512.

converted into a military navy. It was in this way that Venice was enabled to take, and for a time to retain, the city of Constantinople itself. The commerce of the East had also greatly contributed to increase the wealth, and consequently the power, of these free cities. The chiefs of the Crusades, who returned from these expeditions, brought with them from Asia a taste for its luxuries; and for these the maritime cities became the storehouses, supplying the countries in the western part of Europe.

After the death of Pope Alexander IV. in 1261, his successor, Urban IV., among several princes who sought the government of Italy, selected Charles of Anjou, brother of St Louis of France, appointed him king of Naples, a senator of Rome, papal vicar of Tuscany, and finally king of Italy. This gave a new direction to the two parties, the Guelphs and the Ghibelines, which still distracted the country. One of them was considered as the friend, and the other as the enemy, of the French aspirant. Besides these parties, there were also the republics; and besides them, contests between the nobles and the people, in most of which the latter were, in the beginning at least, the conquerors. Charles invaded Naples, and defeated Manfred, the king, in 1265, and thus gave the superiority to the Guelphs, which he further increased by placing a garrison in Florence, and excluding from the councils the whole of the nobles, and all others of the Ghibeline party. He was for a short time alarmed by an invasion from Germany under Conrad, the grandson of the last Suabian emperor. This prince was only sixteen years of age when he arrived at Verona at the head of 10,000 cavalry, where he was joined by all the Ghibeline commanders who had distinguished themselves under his ancestor, and aided by the efforts of the Ghibeline cities, Pisa and Sienna. The citizens of Rome were so disposed to favour him, that on his advance they opened their gates and promised assistance. But all this zeal in his favour was of no avail. He passed the Abbruzzi Mountains, and at the foot of them fought a desperate battle in August 1268. It terminated in the total defeat of the Germans. Conrad, with the chiefs, were made prisoners, and, after a mock trial, were condemned and beheaded at Naples on the 26th of October 1268. After these executions, an uninterrupted exhibition of similar spectacles filled the two Sicilies, and some other parts of Italy, with such horror and dismay, that Charles of Anjou reigned triumphantly, and soon acquired the mastery over the republican cities.

Gregory X., who ascended the papal throne in 1272, saw the impolicy of his predecessors, who had given themselves a French master. He endeavoured to raise the Ghibeline party so as to counterbalance the Guelphs; and engaged Pisa, Venice, and Genoa, to co-operate with him in choosing a chief. The election was made the following year, when Rodolph of Habsburg, the founder of the house of Austria, was declared emperor. Martin IV., who was made pope in 1280, undid the work of his predecessor, and persecuted the Ghibelines with great fury. But in the mean time the popes had secured to the holy see the temporal power over the ecclesiastical territories. During this period hostilities took place between the maritime republics. The Genoese had assisted Michael Palæologus in his successful efforts to retake Constantinople from the Venetians, and had received for their reward the island of Chios. Near to Meloria, in a sea-fight, the Genoese had nearly annihilated the fleet of the Pisans; and in another battle, near Curzola, they had gained the command of the sea by their defeat of the Venetians.

Charles was preparing an armament in all the ports of Naples and of Sicily, with the intention of contending in Greece for the eastern empire. This induced him to levy taxes of great amount with excessive rigour, and the judges endeavoured to prevent resistance by striking terror into all those who declined or even delayed the required payments. John de Procida, the friend and confidant of Frederick and of the deposed Manfred, a native of Salerno, visited secretly the cities of both Sicilies, to re-animate the zeal of the Ghibelines, and to rouse their hatred towards Charles and the French. He had also obtained promises from Greece and from Spain. It was not necessary, however, to have recourse to foreign aid, for a sudden and popular explosion took place in Palermo. It was excited by a French soldier, who behaved rudely to a betrothed lady, as she was on her way with her affianced husband to a church to receive the nuptial benediction. The indignation of her family was on the instant communicated to the populace. The bells of the churches were ringing for vespers; the people answered by the cry, "To arms; death to the French." The French were furiously attacked in every quarter. Those who attempted to defend themselves were soon overpowered; others, who endeavoured to pass for Italians, were known by the pronunciation of the two words "*ceci*" and "*cieri*," which they were forced to utter, and on mis-pronunciation were instantly put to death. In a few hours more than four thousand persons thus perished in Palermo, and every other town in Sicily followed the bloody example. Thus the Sicilian vespers overthrew the dominion of Charles and of the Guelphs; separated that island from the kingdom of Naples; and transferred the crown of the former to Peter of Aragon, the son-in-law of Manfred, who was considered as the heir of the house of Hohenstauffen. The massacre occurred on the 30th of March 1282.

Florence had, by 1282, been led to a democratic state by the attainder of the nobles as a body, and, by its judicious regulations, had greatly strengthened the Guelphic party; but some disputes, which had originated in the neighbouring insignificant town of Pistoja, were extended to Florence, and in a short time divided the whole of Tuscany into two factions of Guelphs, called the *Bianchi* and the *Neri*, or the Whites and the Blacks, whose mutual animosity and hostility were continued till 1300, when, by the intrigues of Pope Boniface VII., and the instrumentality of Charles de Valois, the Bianchi were plundered and expelled the country, upon which a part of them joined the Ghibeline faction. In Lombardy the dying cause of freedom still continued to exist, and was at length rekindled; and the people, wearied out with the feuds of their nobles, between 1302 and 1306 drove them out. At this period, by the management of Philip le Bel, a Frenchman, Clement V. was chosen pope, and removed the seat of the papal throne to Avignon, where it continued till 1377. This gave room for the display of the spirit of freedom in Rome, and in all the territory of the church. The authority and almost the name of the emperor of Germany had been neglected in Italy during sixty years, whilst their minds were wholly occupied with internal disputes. At length, in 1308, the diet of Germany advanced Henry of Luxembourg to the imperial dignity, after three other princes had occupied that station. Henry VII. had little power to enforce obedience in Germany, and foresaw symptoms of opposition, which he wished to divert by flattering the vanity of conflicting parties, and uniting them in projects for extending his authority over the several parts of Italy. Henry crossed Mount Cenis, and appeared in Italy in 1310, accompanied by a few cavalry, not amounting to two thousand, composed chiefly of Belgians, Germans, and some Savoyards. At Turin he was waited on by many of the nobles of Lombardy and Piedmont, who at least professed obedience; and even the cities, in confusion and distress as they all were from their internal contentions, gave indications of a strong desire for tranquillity under their constitutional chiefs. Henry professed impartiality between all parties, and his conduct corresponded with his professions; but he

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wanted money, and it was issued out to him with great parsimony by all but the citizens of Pisa, who were extremely liberal, and increased his force with a guard of six hundred bowmen, who accompanied him to Rome, where he received the golden crown of the emperor from the pope's legate, without the walls, as the citizens refused admission to him and his troops, but had admitted a garrison of Neapolitans. The term for which his foreign troops had enlisted had expired on his coronation, and they mostly left his service; but the Ghibelines and Bianchi of central Italy gathered round him, and formed a respectable force. He made some ineffectual efforts to conquer the democracy of Florence, who had taken a garrison of mercenaries into their pay. He then, reinforced by the Pisans, marched towards Rome to contend with Robert, king of Sicily, who maintained an ill-disciplined force in that city, and expected reinforcements from the Guelphs of Tuscany. On the road, not far from Sienna, on St Bartholomew's day 1313, he received the communion from the hands of a dominican monk, and expired a few hours afterwards, with strong suspicions of having been poisoned.

When Henry died, disputes arose at the diet at Frankfort respecting his successor in the empire; but they seemed to have had little effect on the condition of Italy. In a few years most of the republican cities in the middle of Italy had fallen under the government of some distinguished military family, whilst Tuscany alone maintained a share of liberty, by selecting Robert, king of Naples, as its protector. The Ghibeline city of Pisa found a master in Uguccione della Faggiuola in 1314; and, after his expulsion in 1316, in Castruccio Castracani. Padua fell to the house of the Carraras. Alessandria, Tortona, and Cremona, became submissive under the Visconti of Milan. Mantua fell to the share of Gonza in 1328. In Ferrara the family of the Este established their hereditary power; and Ravenna became the patrimony of the Polentas, who had long held power there. In the other cities the same tyranny was established, but, from generation to generation, so uncertain in its administration as to increase the evils it created. These small princes adhered to Robert of Naples, whose greedy lust of power obtained the means of indulgence by Clement V. having appointed him vicar-general of Italy, designing thereby to hold the balance of parties in his own hands. Louis of Bavaria made his appearance in Italy in 1327, in order to put down both Anjou and the Guelphs. He was supported by the Ghibelines; but, by want of firmness, and a breach of his professions, so estranged them, whilst, on the other hand, the wickedness of Pope John XXII., who supported the Guelphs, had so cooled their zeal in his favour, that the two parties who had so long opposed each other, uniting in the cause of common freedom, were drawn much closer together.

At this period that estimable royal adventurer, John, king of Bohemia, the son of the Emperor Henry VII., made his appearance in Italy; and having been invited by the citizens of Brescia, and favoured by the pope, he was announced as the mediator and pacificator of the kingdom. He arrived in 1330. But his purposes were frustrated by the opposition of Tuscany, where a dread of the government of a single person was generally entertained. His fickle disposition made him soon abandon his objects, and he quitted Italy in 1333.

After his departure, Mastino della Scala, who had been one of his supporters, and who was lord of the half of Lombardy, and of the territory of Lucca, began to threaten the independence of Italy; but he was opposed by a league, headed by Florence, which led to hostilities; but they were soon terminated, and the freedom of Florence was thereby secured. The necessities of Mastino induced him to sell his city of Lucca to the Florentines, upon which the Pisans rose and took that city for themselves. After this transaction, the Florentines, disgusted with those who had caused the loss of Lucca, selected as their chief a military adventurer, who, in the Crusades, had obtained the title of the Duke of Athens; but, owing to his severity, they soon dismissed him. In Rome, torn by aristocratic factions, Cola Rienze was chosen tribune of the people, in order to restore the laws and tranquillity; but after seven months he was obliged to give way before the power of the nobles, in 1347. After a banishment of seven years, in 1354 Cardinal Albornoz was recalled; but his rule was short, having been killed in an insurrection instigated by the nobles. The Genoese, tired out with everlasting quarrels between the Guelphic families of Spinola and Doria, and the Ghibeline families of Grimaldi and Fiesche, drove them all out of their city, and elected their own first doge or duke. In Pisa the Ghibelines were divided into two violent parties, those of Bergolini and of Raspanti, when, after much contention, the latter succeeded in expelling the former, in 1348. At this period Italy suffered from a dreadful famine, which, in 1347, swept away, by absolute starvation, vast numbers of the inhabitants; and in the following year a pestilence of a most mortal nature spread over every part; and such was the suffering produced by these visitations, that it was calculated that two thirds of the whole population were destroyed by them. Another tremendous scourge followed, and was longer endured. After each peace, bands of dismissed soldiers were formed under chiefs, called *condottieri*, who carried on war on their own account, burning some towns, ransoming others, and plundering everywhere. They were mostly Germans, who had been called in by the Viscontis and Della Scalas. A Duke Werner, a Count Lado, and a Friar Morale, led bands of these robbers, who devastated Italy from Montserrat to the extremity of Naples, between 1348 and 1354. Meantime another war had broken out between the maritime republics of Genoa and Venice. The Venetians formed alliances with the Greek emperor and with Peter of Aragon. Formidable fleets were collected, one commanded by the Genoese admiral, Paganino Doria, and the other by the Venetian, Nicolo Pisani. A battle was fought between them on the 13th of February 1352, which proved indecisive; but in a second, fought in the following August, the Genoese were defeated with great loss. In two years success changed sides; and after a defeat of the Venetians in November 1354, a truce was agreed to, which terminated in a peace in the month of May following.

The family of Visconti had raised themselves to great power in the centre of Italy. John of that name had influence in Genoa, intrigued in Venice, and threatened to destroy the independence of Tuscany. He died in 1354; and his power and pretensions, being divided between his three nephews, became weaker, and received a check by the appearance of Charles IV., who again returned to Italy in 1355, where he was enabled to new-model the cities of Pisa and Sienna, and so far to overcome Tuscany, though but for a short period, as to compel even Florence to adopt the title of an imperial city. With but little real power he opposed the Visconti; but ended in obtaining money from them, as he did from most parts of Italy, in his progress through the country. In 1363, he liberated the city of Lucca from the dominion which the Pisans had obtained over it. About the same period Pope Innocent VI., by his legate, between 1365 and 1375, obtained absolute power over the cities of the papal dominions; but lost much of it again, from the discontent excited by the tyranny of the legate, and by the interference of Florence in favour of their freedom. Robert of Geneva, who was elected as pope, and took the name of Clement VII., established his court at Naples in 1378, under the protection of Queen Joan. He was opposed by another pope, namely, Urban VI. The church was thus divided between two popes and two colleges of cardinals, and the temporal power of the holy see was weakened. Several of the cities had been enfranchised by the Florentines; but those of Romagna, with some others, fell under the yoke of petty tyrants.

The continuance of the thirst for dominion of the Visconti in the centre of Italy, where they had rendered themselves masters of Genoa and Bologna, excited a general combination against them, at the head of which was Florence; and the old parties of Guelphs and Ghibelines were forgotten in this new and threatening crisis. In Florence the Guelphs were divided into two parties, the Ricci and the Albizzi. After great tumults, Michael de Lando, of low origin, but a brave and generous man, produced tranquillity in 1378. The party of the Ricci, which had thus been for a moment defeated, was essentially aristocratic, and numbered amongst it the members of the family of Medici, whose names are then for the first time to be met with in Italian history. This party soon afterwards, in another tumult, banished Lando, and those who had supported his nomination, and then constituted the former aristocracy more firmly than it had before existed.

In the other republics the same progress was made. The leaders of the democracy, or their heirs, created themselves tribunes of the people, and became a fresh aristocracy, with the power of transmitting it to their families. At Genoa, a civil war was carried on for a long time between the two strongest parties, but ended in their conferring the sovereignty, in 1396, on Charles VI., king of France.

In Lombardy, Gian Galeazzo, of a French family, had seated himself on the throne of Milan, and having rendered himself master of the smaller cities in that district, alarmed Sienna, Pisa, Bologna, and other considerable places. Being restrained, by the opposition offered by Florence, from attacking them at that time, he succeeded in a few years, and conquered most of them; and ultimately brought Tuscany itself into a dangerous position, from which it was relieved by a pestilence, which, amongst many thousands whom it swept away, carried off also the object of its dread, Gian Galeazzo, in 1402. This event gave a breathing-time to that part of Italy; and, during the minority of the son of Gian, many of the places he had taken were retaken. Milan fell into a state of anarchy, and the Venetians availed themselves of it to conquer Padua and Verona, whilst, on the other side, the Florentines captured Pisa; and Gian Maria, a youth, was only supported on the tottering throne of Milan by the arms of the hired mercenaries. His tyranny and cruelty is painted in the blackest colours by all the writers of his age; and he at length fell a victim to the indignation of some of the nobles, by whom he was assassinated, in May 1412.

In 1409, a new but transitory danger threatened the republic of Florence, by the invasion of Ladislau, king of Naples, which was no sooner repressed than the power of the Visconti became predominant. The Duke Philip Maria of that family, with the assistance of his celebrated general, Carmagnola, between 1414 and 1420, conquered all the states which had belonged to the family in Lombardy; and Genoa submitted to him in 1421. Venice and Florence then made a league in 1425, and General Carmagnola, having turned to these parties, conquered the whole of the territories on the river Adda, and secured them by the peace of Ferrara in 1428. The condottiero Braccio Montone contrived to make himself master of the city of Perugia, and of the whole of Umbria, and extended his power to Rome itself; whilst the Petrucci, in 1430, firmly established their power in Sienna.

After the weakening of Milan by the Florentines and Venetians, and owing to the constant disturbances raised in Naples by the party of Anjou against Alfonso of Aragon, there was no longer any dangerous preponderating power in Italy. There existed, however, constant hostility between the armed military bands, in two divisions, according to their usual practice. One of these was led by Braccio Montone, and the other by Sforza Attendolo. Francis Sforza was enabled to make himself, after the death of Visconti, master of the whole territory of Milan, in 1450. The Venetians, greedy of extended territory, made an alliance with some of the smaller states; Sforza made a counter-treaty with Florence, which, under the change of circumstances, providently changed its policy. At this period the house of Medici, by its wealth and its prudence, began to attract notice and to gain importance in Florence. The power of Milan, where Sforza ruled; of Venice, which possessed the half of Lombardy; of Florence, which was wisely directed by Lorenzo de' Medici; and of Naples, that was not in a state to venture on offensive war; formed, towards the end of the fifteenth century, the political balance of Italy, and, in spite of manifold feuds, gave confidence to each power that its independence was secure.

In 1494, Charles VIII., king of France, advanced towards Italy, designing to conquer Naples; and Ludovico Sforza came forward, first to support, but afterwards to oppose him, whilst the pope, Alexander VIII., in order to elevate his son Cæsar Borgia, courted the French alliance. The opposition to Charles was feeble, but the cruelties and the rapine which he caused or permitted filled Italy with disgust. Ludovico Sforza collected an army in the north, which induced Charles to leave one half of his forces to retain the possession of Naples, which he had gained. He was impeded in his retreat, and lost in it the greater part of his army before he could enter his own kingdom. That portion of his force which he had left in Naples was at length obliged to capitulate at Atilla in July 1496; so that, after two years of war of the most ravaging description, France did not gain the least footing. Louis XII., who had succeeded to Charles VIII. in April 1498, made pretensions to the government of Milan. He was opposed only by Ludovico Sforza, because Venice, who would have joined Ludovico, was engaged in an alarming war with the Turks; and Florence, from which the Medicis had been banished, was ruled by a seditious faction, intent upon subjecting Pisa to their authority. Pope Alexander, who had opposed Charles, formed an alliance with Louis, on condition that his relation Cæsar Borgia should be made Duke of Valentinois in France, and of Romagna in Italy. Frederick king of Naples, though aware that he must be ultimately the victim of France, was too much occupied in restoring tranquillity at home to take any active measures to protect Italy.

Louis, favoured by the position of affairs, passed the Alps with a powerful army in August 1499. He took some small towns by assault, and put the garrisons and most of the inhabitants to the sword; a ferocious proceeding, which produced universal terror, so that Sforza could make no opposition, but dispersed the army he had collected, and withdrew with his family and treasures into Germany. There he found protection with the Emperor Maximilian. The cities of the north of Italy opened with trembling anxiety their gates to the troops of the French king, and he was installed as Duke of Milan in that capital, whilst Genoa, which had been an ally of Sforza, made terms with France. After this hasty subjugation, Louis returned to Lyons. The insolence of the French, their violation of all national institutions, their contempt of Italian manners, the accumulation of taxes, and the irregularity of their administration, rendered the yoke insupportable. Ludovico soon became acquainted with the ferment which prevailed,

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and the eager wishes of his subjects to see him again at their head. He was on the Swiss frontier, and hastily collected a small force. With this he entered Lombardy in February 1500, having only five hundred horse and eight thousand infantry. Como, Milan, Parma, and Pavia, opened their gates to receive him; and after a short siege Novara capitulated. But Louis was active, and his general, Tremouille, advanced to suppress this rebellion with an army in which were ten thousand Swiss. Hired troops of the cantons were in both armies. When they met, these troops had parleys between themselves, and the part in Ludovico's army agreed with those in the army of Tremouille to murder their Italian fellow-soldiers, and to leave the service in which they had entered. This was executed. Ludovico Sforza was delivered up and sent to France, where he died after ten years' imprisonment; and the Swiss returned home with the wages of perfidy and the curses of Lombardy, whilst the French continued masters of the country till 1512.

The French then attempted to gain Naples, and a most infamous treaty was concluded with Ferdinand the Catholic, of Spain, who had engaged to defend that kingdom, by which that unfortunate country was subdued; and in the division of it quarrels broke out between the French and Spaniards, in consequence of which, after a battle had been gained by Gonzalvo, the general of the latter, the French were in 1503 completely driven out, and the kingdom of Naples became an appendage of the Spanish crown.

By the death of Pope Alexander VI., and the accession of Julius II., the pretensions of Cæsar Borgia vanished, as the new pontiff was more zealous to strengthen the holy see than to advance the son of his predecessor. With this view he formed a treaty with the kings of France and Spain, called the League of Cambray, in 1508, the object of which was to check the engrossing measures of the Venetian republic; but it having failed in that respect, by the cunning of the Venetians, his holiness, in 1509, entered into a treaty with the Venetians themselves, in which the king of Spain and the Swiss cantons were comprehended, the purpose of which was to drive the French out of Italy; but this project was abandoned by the pope, from the dread that the council of French and German prelates assembled at Pisa would be induced to declare his election to the popedom invalid, and dismiss him from the dignity. In the mean time Maximilian of Germany and the king of France had concocted an alliance at Blois, by which it was agreed to divide between them the whole of the dominions of Venice on the continent; and, in consequence of it, hostilities commenced in 1509. The cities surrendered to the French, the Germans, or the Spaniards, all of whom exercised the most abominable cruelties. The pope, in the midst of the conquests of the great powers, became alarmed, and, with the cunning of an Italian, attempted to free Italy from their ravages, by inflaming the emperor against the French, by forming a league with Venice, and by calling in the aid of the mercenary Swiss. The pope raised an army, commanded by the Duke of Urbino; and though it was defeated in 1511, he succeeded in forming a league, to which the prefix of Holy was given, on account of his being at the head of it, with the kings of Spain and of England, and which also comprehended the Swiss and the Venetians.

A powerful Spanish army from Naples, in 1512, advanced to assist the pope, commanded by Raymond de Cordova. He was gladly received by the people, but opposed by the most experienced of the French generals, Gaston de Foix, with whom he fought a most murderous battle near Ravenna, on the 11th of April 1512; and though the French were victorious, yet the loss of Gaston, who fell in the action, was more than a compensation for the defeat which the Spaniards had sustained. Maximilian suddenly betrayed his allies, recalled the German troops from the French service, and gave a passage through his territory to the Swiss to join the Venetian army. Ferdinand of Spain and Henry VIII. of England simultaneously attacked France, who was thus obliged to recall her troops from Italy, and abandon the country to the power of the Holy League. The liberties of Italy were then annihilated. Florence, with Tuscany, a country rich and factious, but not warlike, after being plundered by the Spaniards without pity or remorse, was delivered over to the banished but now restored Medicis, where Giovanni de' Medici, afterwards Pope Leo X., with some other members of that family, reimbursed themselves for their long proscription, by the abundant wealth they employed their power to extort.

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Charles of Ghent, commonly called Charles V., already king of Spain, on the death of his grandfather Maximilian, was raised to the imperial throne in 1519. Charles, and Francis the king of France, had abundant subjects of contest; but Italy was doomed to become the theatre for their decision. Francis, in 1523, sent an army under Bonnivet to invade Lombardy and take possession of Milan. The city had time to collect stores and complete its defences, owing to the supineness of the French general, and thus was preserved from capture till the emperor could furnish an army of sufficient strength to meet Bonnivet in the field.

1512 to 1792.

In the next year the imperial army received such reinforcements that Bonnivet thought himself unable to resist it, and resolved to withdraw his troops. On the retreat he was wounded, and the command devolved on the Chevalier Bayard, who was killed in the battle; after which the remnant of the French escaped to their own country, leaving Lombardy in the power of the imperialists. Charles was so elated by the success of his arms in Italy that he resolved on invading the patrimonial dominions of Francis, and accordingly Pescara led his army into Provence, and began the siege of Marseilles; but the attempt proved unsuccessful, and its repulse encouraged Francis once more to make an attempt to retrieve the reverses he had suffered in Italy. The French passed the Alps by Mount Cenis, and the rapidity of their movements enabled them to enter Milan, which was unprepared for the attack; but the imperial general secured and garrisoned the citadel, which in some measure commanded it. Francis then laid siege to Pavia, which was strongly fortified, and garrisoned by six thousand veterans. The siege occupied several months, and thus gave time for Charles to collect his troops. Francis was resolved to fight, though urged by his generals to avoid a battle. On the 24th of February 1525, the two armies engaged; the contest was obstinate, and the issue long doubtful; but after dreadful carnage, the imperialists were victorious, Francis himself was taken prisoner, and with him Henry king of Navarre, and a few only of the body guard escaped. The French in Milan retired, and, in fourteen days after the battle, not a soldier of the nation remained in Italy.

After this last French attempt on Italy, which had, like all that preceded, only shown that a temporary ascendency could be obtained by that nation, but could never be retained, the preponderating influence was securely held by the Emperor Charles V. Most of the reigning houses disappeared, and their successors were appointed either avowedly or secretly by him. When the male line of the Marquis of Montserrat became extinct, Charles, in 1536, gave his dominions to Gonzaga of Mantua; and Maximilian II. in 1573, created it a dukedom. The Florentines made an attempt, after murdering the Duke Alexander in 1573, to regain their independence; but their efforts were unavailing, and Cosmo de' Medici was raised to supreme power by the influence of Charles. Parma and Placentia had been seized upon by Pope Julius II. for the holy see; but Paul III. in 1545 erected those states into a dukedom for his bastard Peter Aloes Farnese, whose son Octavio, in 1556, was invested by the emperor. Genoa, which, since 1499, had submitted to France, found a deliverer from that power in the person of Andreas Doria, who established a firm aristocracy, which overcame the conspiracy that Fiesco had projected to destroy it. Charles, in 1553, had conveyed Milan, and also the kingdom of Naples, to his son Charles. At the peace of Château-Cambresis, in 1559, Philip II., and Henry II. of France, renounced their pretensions to Piedmont, which was given to the legitimate heir, the brave Spanish general Emanuel Philip, duke of Savoy. In 1597, the legitimate line of the house of Este became extinct, upon which Cæsar d'Este, a natural son of the last prince, obtained Modena and Reggio by an enfeofment from the empire; and Ferrara was conveyed to him as a feudatory of the papal throne.

The end of the sixteenth century was a period of peace in Italy, and of such prosperity as could be expected after it had lost the foreign trade which had proved so lucrative, and which had been so long enjoyed by the discovery of the way to India by the Cape of Good Hope. In the next century only some insignificant changes of territory took place. Some reverses in Germany induced the Emperor Ferdinand II. in 1631, when the family of Gonzaga became extinct, to grant Mantua and Montserrat to Charles de Nevers, a protegé of France, whose descendants retained it till the war of the succession in Spain. In the peace of Chierasco in 1631, the cunning of Richelieu obtained Pignerol and Casale, which might serve as means of facilitating an irruption into Italy; but, in 1637, he was obliged to give up the latter fortress. The peace of Italy was not disturbed by any of the operations of Louis XIV. of France, and seems to have been durably secured by its neutrality being made one of the stipulations of the treaty of Turin in 1696.

The effects of the war of succession in Spain were extended to Italy. Austria conquered Milan and Montserrat, and the Duke of Mantua was expelled on account of his crimes. Montserrat was ceded to Savoy, and the two other cities retained by the house of Austria. The peace of Utrecht, in 1714, conferred Sardinia and Naples on the emperor, and Sicily on the house of Savoy; afterwards the two powers exchanged the islands, and the house of Savoy, thus gaining Sardinia, assumed the title of kings of that island.

The family of the Farnese became extinct in 1731, when the Infant Charles of Spain received the investiture of Parma and Placentia. In the war respecting the Polish succession, which broke out in 1733, Emanuel of Savoy, now king of Sardinia, formed an alliance with France and Spain. By this he was enabled to take possession of the duchy of Milan; but at the peace of Vienna, in 1738, he was compelled to restore it to Austria, being allowed to retain only Novara and Tortona. The Spanish infant, who had become king of the Two Sicilies, delivered up Parma and Placentia to the house of Austria. The family of the Medicis had enjoyed the title of Dukes of Tuscany with great tranquillity; but the last member of it dying in 1737, Francis Stephen, duke of Lorraine, by the preliminaries of the Vienna treaty, was invested with the sovereignty; and, in 1745, it was settled as the possession of the second son of the Lorraine-Austrian family. In the war of the Austrian succession, in 1745, the Spaniards conquered Milan, but were driven out by Charles Emanuel; for which service Maria Theresa conceded to him the districts of Vigevanasco and Bobbia, and some portions of Anghiera and of Pavia. Massa and Carrara fell by hereditary succession to the Duke of Modena in 1743. Parma and Placentia were taken possession of by the Spanish infant Don Philip, who soon lost it again; but, at the peace of Aix-la-Chapelle in 1748, he once more received it, and continued to hold it as an hereditary possession. Thus, at nearly the termination of the century, in 1792, the houses of Lorraine, Spain, and Savoy, were the rulers of all Italy except the states of the church, the duchy of Modena, and the republican cities, in which the decrepitude of old age was making rapid advances.

As the narrative of the events by which Italy fell under the dominion of Bonaparte is communicated in this work under the head FRANCE, it is only necessary to refer the reader to that article. When quiet possession of the peninsula had been gained in 1797, republicanism was in the ascendant at Paris, and the Cisalpine republic was formed. Lombardy was extended by adding to it a portion of the papal territory. Genoa formed another republic, called the Ligurian; and Venice, which had submitted without opposition, also adopted a republican form, though it was soon afterwards transferred to Austria by the treaty of Campo-Formio. Naples also was, in 1799, formed into a republic, under the denomination of the Parthenopæan. Amidst the greatest oppression and the most wanton cruelty, this state of affairs continued till their conqueror became first consul, when the Cisalpine republic was new-modelled after the pattern of France, and converted into the Italian republic, with Bonaparte as its president. In 1805, when the military regime was completed in France, and Bonaparte had become its emperor, the same kind of monarchy was forced upon Italy, and he was crowned at Milan on the 26th of May, with the iron crown of Lombardy. About the same time Naples was converted into a kingdom for his brother Joseph, who, however, was soon compelled to abandon it, in 1808, for the throne of Spain, and was succeeded by General Murat. For one of his sisters, who had married Paschal Bacciochi, Parma and Piombino were formed into a kingdom, to be called that of Etruria; but it was soon destroyed, and converted into a province of France. Though Naples was subdued, the legitimate monarch took refuge in Sicily, and was enabled to maintain himself by the assistance of the English navy and army. Whilst Murat reigned as king in Naples, and Eugene Beauharnois as viceroy in Milan, they were both summoned, with all the forces they could collect, to join the grand army for the subjugation of Russia. After the retreat from Moscow, both returned to their dominions with the remnant of their forces. Eugene maintained the fidelity for which he had engaged; but Murat, offended with Bonaparte, formed an alliance with the confederated monarchs of Europe. After the abdication of the imperial throne, Eugene withdrew, and the states in the north of Italy soon returned to the government of their ancient rulers.

On the return of Bonaparte from Elba in 1815, Murat took up arms, as he affirmed, for the independence of Italy. With the Neapolitan troops he advanced towards the north, and entered Bologna; but was soon driven from thence, and afterwards defeated near Tolentino, upon which there was an end of his kingdom. The capital was entered by the Austrian general Nugent, and Murat fled to France, whilst his wife and family found a refuge in Austria. Ferdinand returned from Sicily to the capital of his continental kingdom, and was received with delight by the inhabitants. Murat made a feeble attempt to recover his kingdom; but having collected a small body of troops in Corsica, and landed with them on the coast of Calabria, he was made prisoner, tried by a military tribunal, and shot. By the final treaty of Vienna, the following arrangements regarding Italy were agreed to, and still remain. The king of Sardinia received back all his dominions, according to the boundaries existing in 1792, with some few changes in the limits on the side towards Geneva. To these were added the city of Genoa, and the

History. territory attached to it in former times when it was a duchy. The emperor of Austria united with his hereditary monarchy the newly-erected kingdom of Venetian Lombardy, in which was included the districts of the Valteline, Bormio, and Chiavenna, parts of the Swiss canton of the Grisons. Istria was not included in the Austrian kingdom of Illyria. As the boundary between the popedom and Parma, the valley of the Po was fixed upon. The house of Este was again declared sovereign over Modena, Reggio, Mirandola, Massa, and Carrara. The Empress Maria Louisa received the state of Parma as a sovereignty for her life, after which it was to fall to the Duchess of Lucca and her heirs, who were to give up a territory in Bohemia to the Duke of Reichstadt, the son of Napoleon and Maria Louisa, who has since died. Prince Ferdinand of Austria received Tuscany, with the title of Grand Duke, as before his dismission, and the district of Piombino; and also the sovereignty of the isle of Elba, but reserving in that island the rights of Prince Buoncompagni Ludovisi. The Infanta Maria Louisa received Lucca as a sovereign dukedom, and with it a yearly pension of 500,000 francs, till the decease of the Empress Maria Louisa. The pope was fully reinstated in all his dominions, with the exception of a few small portions on the left bank of the Po; but Austria reserved the right of recruiting in Ferrara and Commachio. Ferdinand of Naples was again acknowledged as king of both Sicilies, and the republic of San Marino and the Prince of Monaco were guaranteed in the full enjoyment of their ancient rights.

The restoration of the old governments was not followed by the immediate return of tranquillity, and much less of contentment. A large army had suddenly changed its colours, and the officers serving in it feared that a change of masters might be unfavourable to their professional advancement. There was, or soon arose, a disposition to speculate on forms of government, to which Italy had always a strong tendency; and though it had been repressed by the military and inquisitorial power in the hands of Bonaparte, it was only stifled, and, when that power was destroyed, spread with great rapidity. This naturally engendered republican feelings; and the idea of uniting the whole of Italy into one large republic, to be administered solely by natives, was too flattering to the vanity of a people accustomed to view all foreigners as barbarians, not to meet with numerous adherents. The proselytes were chiefly found amongst those least capable of calculating the capability or the consequences of their projects. The spirit of change was deeply imbibed by the active part of the people, and especially those of immature age; the students in the colleges, the inferior officers in the civil and military departments, and the younger members of some of the noble families who were reduced to poverty by the exactions which had been practised by their late masters. In the recollection of what Italy had been fifteen centuries before, when she ruled the world, they overlooked many centuries during which she had since been subjected to Goths, Lombards, Germans, Normans, and Spaniards, and at intervals to the French. They never adverted to the condition of that most numerous class of all, the peasantry, who had formed the armies of Cæsar and of Pompey, when independent in mind and powerful in body, but had since become the most ignorant, thoughtless, superstitious, and degraded of all the serfs of Europe. Though there were abundance of revolutionary projectors, and extensive conspiracies formed, yet the hands that were to execute the purposes of such leaders completely failed when collected together, if opposed by only a mere handful of disciplined troops. This had been seen when Murat led a large army proclaiming the independence of Italy, and promising to deliver it from all its transalpine intruders. The same spectacle was exhibited in both the attempts at revolution which were made in Naples and in Piedmont. History

In Austrian Lombardy the same tendencies to revolution existed as in the other parts of the peninsula; but they were checked by the vigilance of the police, and by an armed force, which, as they spoke a different language from the conspirators, was not to be infected by the general mania of the natives. In the other parts of Italy, where the army was composed of natives, the prevalence of revolutionary views was easily communicated, and perhaps nowhere prevailed more generally than amongst all ranks of the officers. This was especially the case in Naples, where the army that had been created by Murat, and officered by him, was placed by the restored king under the command of the Austrian general Nugent, to the great mortification of all in the service. The French military regime was exchanged for that of Austria; the taxes upon land were increased; and, by an agreement with the pope, many of the abolished monasteries were re-established. These arrangements gave force to the speculative opinions which prevailed of a republican kind, and originated many secret societies, the most extensive of which was that of the *Carbonari*, which, if we may trust to the oaths and declaration as published by their enemies, was of the most atrociously murderous and diabolical kind.

Although the societies of the Carbonari had been opposed by another society, called the *Calderari*, adhering to the royal party, and employed by the police, it was said that they counted amongst their members, and those who favoured their proceedings, more than six hundred thousand individuals, including all the provinces of the kingdom. This vast combination, though to a certain degree known to exist, and to be numerous, made no public demonstrations of its force till a revolution had broken out in Spain. The excitation produced by that event spread throughout Italy, but the strongest effect was experienced at Naples. On the 2d of July 1820, Michael Morelli, a lieutenant of cavalry, and Luis Minichini, a priest, excited some troops quartered at Nola, by some violent harangues, to cry aloud, "God, the King, and the Constitution." They were soon joined by an officer of the guards with about twenty men, and the next day marched to Avellino, the capital of the province, where one of the conspirators had already declared the insurrection, and gained over more troops, when the united bodies advanced to Montefort, and took up a position, which they surrounded with intrenchments. Some troops were sent by the government, under General Campana, to reduce them to submission; but these troops discovered no disposition to act. Another general, Carascosa, with more soldiers, was pushed on; but they also refused to fight their brothers. On the 5th, General Pepe, at the head of a regiment of dragoons, proceeded from Naples and joined the insurgents, and was then declared their chief. Messengers were sent from the army to the king with petitions, requesting him to grant a constitution. He had no troops that could be relied on, and promised to present them with the plan of a constitution in eight days, and in the mean time dismissed his ministers, and replaced them by some of the leaders of the troops. This did not satisfy the impatient insurgents, and they demanded that within twenty-four hours the Spanish constitution should be adopted. The king appointed his son viceroy, and he assented to the proposition in his father's name.

The Spanish constitution thus proclaimed, was that of the Cortes of 1812 in Cadiz, of which no one in Naples had any knowledge, nor could even a copy of it be found in the city at the time of its adoption, as a fundamental law of the regenerated kingdom. In ten days, without a drop of blood being shed, a military revolt placed the revolutionists in the possession of the full power of the kingdom. An insurrection almost immediately broke out in Sicily, which, acting on the same principles, required independence; and the populace having broken loose, committed many disorders, such as breaking open the prisons, robbing the rich, murdering several persons of rank, and amongst these Prince Catholico, and assassinating others; so that on the 17th of July, three days after the events in Naples were known, fifteen hundred persons were killed and wounded in the city of Palermo, and confusion prevailed in every other part of the island. General Pepe was sent with a body of troops to restore tranquillity. He found the cities in a state of horrid confusion, some taking the part of the Neapolitans, and others insisting on independence. This state of misery continued till the whole insurrection in Naples was quelled.

Whilst Sicily was thus suffering the worst of horrors, the revolution in the continental part of the kingdom proceeded with less confusion. An assembly was convened, and adopted the Spanish constitution with some few trifling alterations. Though suggestions were made by some of the members, that some conditions taken from the English or French constitutions, or from some of those states in Germany which had recently received constitutions, would be desirable, they were scarcely attended to, and none of them acquiesced in. A great military force was decreed, to consist of fifty-two thousand regular troops, two hundred and nineteen thousand moveable national guards, and four hundred thousand local national guards, besides ten thousand gens-d'armes and coast-guards. The spirit of the regular troops could not be relied on, as many of the best of the officers had resigned their commissions. In a very short time the treasury was exhausted, though it had been left in a prosperous state; and it became necessary to borrow money from a Parisian banker, who advanced 1,500,000 ducats at a high rate of interest. The expenditure had increased at the rate of 4,084,000 ducats, whilst the income had diminished at the rate of 2,916,000 ducats, annually.

In these new hands every branch of the administration had become confounded, and embarrassed each other; the courts of justice decided nothing, the number of criminals increased, and trade was stagnant. These circumstances existed at Naples when the congress at Troppau, consisting of the emperors of Russia and Austria, and the king of Prussia, with their ministers, and the ambassadors from the other powers of Europe, had assembled, and in November had decided on a military interference in the affairs of Naples. Austria at this time had marched an army of eighty thousand men into her Italian provinces, under the command of General Frimont. Great Britain and France had each placed a naval squadron in the Bay of Naples, which were appointed to watch over the safety of the king and the royal family. These preparations excited the feelings of the several parties in the capital, producing on one hand suspicion and distrust, and on the other hope and joy. The king of France had offered to mediate between the parties, and suggested that the king should have the veto, the choice of his ministers, and the power of dissolving the assembly; but such propositions received no attention.

The three combined monarchs had on the 20th of November written a letter to Ferdinand, inviting him to meet them at Laybach; and the king of France had urged him to take this step. He resolved on doing so, and announced his resolution to the parliament on the 9th of December, and required that, during his absence, no changes in the constitution should be made. This communication produced much violent debate, and the answer given was a resolution, "that any proposition to alter the Spanish constitution being contrary to the oaths of the king and the parliament, they consent to his majesty undertaking the journey, on the condition that he will take the proper means to secure the acknowledgment of that constitution." To this resolution the royal reply was, that his majesty had never entertained any designs to change the constitution; but that, to avoid a war, it was advisable, by the king's mediation at Laybach, to obtain the sanction of the congress to what had been done, and that no further changes should be made during his absence. The parliament persisted in their resolution, and the king, on the 10th of December, declared that his mediation should have no other object than to maintain in its integrity that Spanish constitution that had been already sworn to, and to avert a war. The crown prince was then appointed regent; the king and his consort embarked in an English ship of the line on the 13th of December, landed at Leghorn on the 19th, and thence proceeded through Florence to Laybach.

The prince regent seems to have given way to the impetuosity of the parliament, to have passed some very revolutionary laws against the nobles of Sicily, and prepared as well as they could to arrange an army, which then was composed of fifty-four thousand troops of the line, and sixty thousand militia and volunteers; and they all appeared very energetic in the cause they had espoused.

When the king arrived at Laybach he was soon made acquainted with the decision of the congress, not to acknowledge as legal any transactions which had passed in Naples since the 5th July; and that the power of suppressing what was deemed a military revolt should be intrusted to the emperor of Austria. This resolution was made known by the king to his son, who acted as regent in Naples. At the same time the ambassadors of the combined powers made known, through the secretary of state for foreign affairs, to the prince regent, that an Austrian army was ready to enter the kingdom and to occupy it; and that if that was insufficient, a Russian army would also receive orders to join their force. The regent replied that he should make this known to the people, from whom he should not separate himself, because in all that had occurred great moderation had been shown, and the greatest respect displayed towards the royal family. The regent replied to the king, that as he could not believe the communication from his majesty to be a voluntary act, he should adhere in every way to the people, and share all dangers with them; upon which the ambassadors of the allied powers withdrew from Naples.

Preparations were now made for defence, and a proposal, that for the present the constitution should be suspended, and the regent declared dictator, was negatived. General William Pepe called to arms the whole of the people, arranged under ancient names, such as the legion of Brutus, of the Samnites, and others, and added them to the regulars, thus mustering a hundred and fifty thousand men, but many badly armed and clothed, and worse disciplined. The plans for defence were well arranged had the troops been well composed. The Austrians advanced, the first encounter happened on the 5th of March, and by the 10th a general dispersion of the whole army had taken place. It is not necessary to relate the several movements of the two armies. Many of the Neapolitans were killed in their flight; but the Austrians assert that they lost in all the combats not more than seventy men. The Neapolitan troops of the line soon joined themselves to the Austrian army, and the volunteers and militia returned to their homes. The Carbonari talked loudly of carrying on a guerilla war amongst the mountains, but it produced no effect. Naples, with the fortresses of Gaeta and Pescara, capitulated on the 23d of March; the lodges of the Carbonari were dissolved, the leaders, including the two generals, Pepe and Carascosa, obtained passports to foreign countries; and the last sparks of the revolution were speedily extinguished.

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The king had arrived at Florence, whence he arranged a provisional government, which speedily abolished the whole of the republican institutions, and restored such as had previously existed. The troops of the line were disarmed and disbanded, and the volunteers stripped of their arms and accoutrements. The police was established on its ancient footing; and some of the leaders of the revolt were prosecuted, of whom a few were executed after trials before the restored tribunals. A detachment of the Austrian army passed over to Sicily, and in a short time restored tranquillity in that island, after having disarmed a few parties of guerillas that infested the mountainous parts of it, whilst those who had commanded them fled into Spain. The restored government conducted the prosecutions with great mildness. Forty-three of the most conspicuous persons were brought to trial, of whom thirty were condemned to death, but only two of them, Morelli and Gilvati, were executed. On the 22d of September an amnesty was issued, from which only eleven persons were excepted, viz. General Pepe, the monk Minichini, Concilio, Carascosa, Rossarol, and six others, all of whom had taken refuge in England. Thus, in little more than fifteen months, the Carbonari insurrection was completely defeated, and the people returned to their usual habits, occupations, and gratifications.

The revolution which broke out in Piedmont whilst that in Naples was in operation, originated in the same causes, but varied in its progress, because it was more especially of a military character, and headed by persons of more weight, as well in the civil as in the military departments. The chief leaders of the insurrection were the Marquis Carlo de St Marzano, son of the minister for foreign affairs, Colonel Provano de Collegno of the artillery, the Counts St Michael and Santa Rosa, officers of the staff, Captain Count de Lissio, and some others, forming a confederacy to which they had given the name of the Italian League. They had resolved to select as their chief Prince Carignan, the heir apparent, who, they asserted, felt great zeal since the revolution at Naples, and was the best qualified to become the prince or king of New Italy. According to their representation, he had, on the 6th of March, acted with them, on the 7th he had declined proceeding, and on the 8th he had again consented to the revolution. On the 10th of March the revolt began in the regiments at Fossano, Tortona, and Alessandria, where the officers had gained over the men by spreading rumours that the Austrians had resolved to disband the Sardinian army, and to garrison the fortresses with their own troops. In vain the king contradicted the rumour; the insurrection increased, and a council of the officers, of which Ansalti was president, issued a declaration in the name of the Kingdom of Italy. From Alessandria the infection spread to Turin, where the general cry was "Long live the king and the Spanish constitution." The people in the capital remained quiet, and a part of the garrison was marched against the insurgents.

On the 12th of March the king issued a proclamation commanding tranquillity and obedience, affirming that the garrisons of foreign troops should never be admitted; but on the same day the officers, with some of the students, seized on the citadel of Turin, by which the populace became excited, and in crowds exclaimed for the Spanish constitution and for war with the Austrians. Upon this the king, who had assented to the resolutions of the congress of Laybach, could not yield to the popular cry, and resolved to abdicate the throne; and on the 13th he did so, appointing, in the absence of his brother Felix, who was the next in succession, but at Modena, Prince Albert Carignan as regent. The whole of the ministers were then dismissed, the state prisoners liberated, and the Carbonari were everywhere triumphant, except at Nice, to which city the king had removed. The new regent found himself compelled to obey those whom he had expected to lead, and declared for the Spanish constitution, but with a reserve in behalf of the king's consenting to it. He then appointed new ministers, a council or junta, and promised to convene a parliament.

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In Novara and some other places a dislike of the Spanish constitution was displayed; and in the whole of Savoy an aversion to the revolution prevailed. Amongst those who had favoured the revolution great differences arose. Many, and those the most thoughtful, preferred the constitution of France with two legislative bodies, to that of Spain with a single one. On the other hand, the revolution found many partisans in Lombardy; and many of the young men from Milan and Pavia hastened to join the revolted troops at Alessandria, which was the central point. Prince Felix at Modena refused the crown, declared the abdication to have been forced, and consequently illegal, and placed Count Galieri della Torre as commander in Novara, to take the command of the loyal troops and suppress the rebellion. This event tended greatly to damp the spirits of the revolutionary party; they still, however, remained triumphant in Turin, where the ambassador from Austria was dismissed, and preparations made to assemble a force and invade Lombardy under the command of Count Santa Rosa. But on the night of the 23d of March, on which the resolution had been taken by the council, the prince regent fled to Novara, thence to the Austrian headquarters, and then to Modena; but, being refused admittance to Prince Felix, he took up a short residence at Florence, and afterwards served in the French army which restored royalty in Spain in 1823.

. The revolutionists continued to encourage their party by assurances of speedy assistance from France, and of great accessions by the revolting of the Austrian troops; but the news of the defeat and dispersion of the Neapolitan insurgents among the Abbruzzi Mountains, which arrived at this period, inclined the Piedmontese to attempt a treaty, by which an amnesty should be granted, and stipulations made against the entry of any foreign troops. This, however, proved ineffectual, for the troops at Novara, under Della Torre, outnumbered any the insurgents could collect; and in Turin many abhorred the new system, and it was their desire that, without foreign troops, the revolt should be suppressed; but Felix at Modena had applied to the Austrian commander, and Count Bubna at the head of five thousand men joined forces with Della Torre, at two o'clock in the morning of the 8th of April at Novara. The troops of the insurgents appeared before that city at daybreak, and a battle ensued. They fought bravely, but were at length defeated. The native troops advanced to Turin, and the insurgent fortresses surrendered to the Austrians. The junta at Turin dissolved itself, and on the 10th the citadel was delivered up to Della Torre. The king renewed his abdication, and his brother Felix assumed the title of king. His power was now as unrestricted as that of his brother had been, and he instituted a tribunal for the investigation of crimes, and punishing the offenders; but most of them had escaped, many by way of Genoa to Spain, and others through Switzerland to France. It was shown before the tribunal that many of those who were arrested had acted by orders from Prince Carignan at the time he was the legal regent of the kingdom, and upon this ground they were unanimously acquitted. The property of sixty-five persons who had escaped was declared to be in a state of sequestration. Twenty-one others were declared guilty of high treason and condemned to death; and the same number were doomed to the gallies, with the confiscation of their goods. Of all these, only thirteen were apprehended, amongst whom were two who had been condemned to death. Only one, however, was executed;

he was a captain of cavalry, named Garelli. The other, in his flight by sea, had been driven on shore and captured; and showing that he did not return by design, he was only banished for life.

This mild administration of the judicial tribunal, with a general amnesty, and rigid decrees to prevent any secret societies being formed, soon restored tranquillity; and the absence of so many leaders of revolution seems to have extirpated the roots of that spirit which, for a short period, had threatened a most fearful civil war. As the revolt in Spain in the year 1821 had been one of the exciting causes of the insurrections in Naples and Piedmont, so it appeared that the revolution in France which seated Philip of Orleans on the throne of that kingdom was the proximate causes of the disturbances which broke out in Italy in 1831.

The complaints in Italy were general, and the remedy sought varied according to the opinions in the several states; but there was one opinion in which all who were dissatisfied united, namely, that the only cure for the evils they complained of was to be found in a general government, which should unite under one legislative body, composed wholly of Italians, the interests of all the states into which the country is at present divided. The feeling towards the ultramontane barbarians, for such they had been taught to consider the rest of the European nations, was by far the strongest and the most universally diffused, and an appeal to that feeling was a certain way to form combinations with the avowed object of expelling them.

If some secret societies had existed in Italy before, they increased in number and became more apparent after the transactions in Paris; and the most eager hopes were held out by those who took the lead in such societies, that if they came to an open rupture with their sovereigns, they might rely on effectual assistance from the newly-established power in France.

The combinations formed, though watched by the police, continued to increase till they were thought by their leaders to be sufficiently powerful to act with effect. The first disturbance began at Modena, on the 3d of February 1831. It was led by one Minotti, and consisted chiefly of young men. The troops were called out, and some fighting in the streets took place, in which the insurgents had the worst, and retreated to Minotti's house, where they were shut up; and cannon being brought, they surrendered with their leader, and were made prisoners. Thus all appeared again tranquil; but two days afterwards intelligence arrived from Bologna that the insurgents in that city had been successful, and that its influence extended to Reggio. A new and much more formidable revolt then broke out. It gained strength, so that the Duke of Modena deemed it wise to withdraw from his capital, escorted by his troops, and accompanied by his prisoners, Minotti and his companions, and to take refuge in Mantua, where was a strong garrison of Austrian troops. He left at his departure a council of regency, which the people soon dissolved, and then nominated a provisional government, upon which the populace plundered the palace, destroyed the custom-houses on the frontiers, and committed other disorders.

At Bologna, a city of sixty thousand inhabitants, there was only a small garrison of papal troops, not exceeding six hundred in number. On the 4th of February an insurrection took place, chiefly composed of young men, many of them the students of the university. They assembled round the palace of the cardinal legate, who was absent, and required of the pro-legate the resignation of his authority, and that it should be delivered over to a provisional government. He at first refused, then hesitated, and at length complied. The soldiers received and obeyed orders from the newly-appointed council; but their commander, with the pro-legate, withdrew to Florence. The temporal power of the pope was abolished by a decree of the provisional government, and a national guard on the French model was ordered to be formed. This success at Bologna spread the spirit of revolt through all the delegations from that city to Ancona; and the latter city capitulated, with its citadel, to a slight force of the insurgents which appeared before it. A great part of the papal territory was thus under the insurrectionary power. Their force indeed entered the Apennines, intending to advance to the city of Rome itself; but being disappointed in the expectations they had formed of some revolutionary movements in that city, they abstained from any attempt on it.

In Parma the transactions nearly resembled those in Modena. The duchess was compelled to withdraw, and, escorted by her troops, found an asylum at Piacenza, when her subjects also formed a provisional government.

Strong expectations had been indulged by the insurgents of similar movements in the other parts of Italy, and especially in Piedmont and Tuscany; but no symptoms of it were manifested in them, and the whole of Lombardy under the Austrian power remained in a state of anxious tranquillity. Austria had drawn a large force from her hereditary dominions, which had reached the Italian provinces, and was said to amount to a hundred thousand men, well disciplined and well appointed. Had the revolutionary bodies, who began to assume some regular order, been in possession of even common prudence, they would have avoided any step which could have provoked or justified Austria in interfering in their affairs, which, knowing the tendency of the Austrian court, they might have been convinced, would be pleased with a pretext for undertaking active operations.

Instead of temporising or disguising their views, no sooner was the provisional government assembled, than, vain of their newly-acquired power, they issued a proclamation inviting the Lombards to join them in their federation. "Brave patriots of Lombardy," said they, "follow the example of France, imitate the example of Italy, burst asunder the chains with which the holy alliance hath fettered you. You are the slaves of foreigners, who enrich themselves by despoiling you, and by rendering you daily more miserable. On the day of your rising, forty thousand of our patriots will march to assist you in crushing the Austrians. Let there be no delay, for there is danger in hesitation. Display your courage, fellow-countrymen, and despotism will flee from our lands." Similar addresses were issued to the subjects of the king of Naples and of the king of Sardinia; but they had suffered too much by the transactions of the year 1821 to be easily excited; and besides, those who might have proved the most active leaders had been banished, and were dispersed in various countries. Under the mild and paternal government of the Duke of Tuscany, whatever dispositions might exist, or whatever sympathy might be felt for the neighbouring insurgents, no manifestations were displayed, but tranquillity was universally enjoyed.

France, at the period when Philip was hardly seated on the throne, had declared that she would not permit Austria to interfere in Italy; but at a subsequent period, when the new monarch had become firmly fixed in power, an explanation was given, stating, that the declaration did not bind him to take any measures to prevent such interference. The Italians who had revolted were, however, buoyed up with the expectation of assistance from France, and the provisional governments spread the delusion long after it was known that the expectation was vain.

France was not at that time in a condition to take any effectual part. Her army was not formed, nor her financial credit established, till after the fate of Italy was decided. She could only come in contact with the insurgents by forcing a passage through Switzerland; and, having suc-

History.

ceeded in that, she would have to encounter the well-appointed armies of the emperor of Austria or of the king of Sardinia, or of both united. The negotiation between Austria and France seems to have terminated in an understanding that the former power might make use of its troops to suppress the several insurrectionary parties in Italy, but not permanently to occupy the several countries in which they prevailed.

The troops of Austria did not suspend their operations on account of the negotiations with France. The Po was passed immediately after the promulgation of the address inviting the Lombards to insurrection. One division of the army advanced to Modena without opposition. The duke returned to his capital, and was reinstated in his power. His conduct towards the insurgents was mild; some of them were brought to trial, and a few convicted, but Minotti was the only one who suffered death. Another division marched to Parma; the inhabitants submitted; the duchess returned to her palace, and granted a free pardon to all persons connected with the revolt, excepting those who had occupied seats in the civic congress; and they suffered no infliction except that of being declared incapable of filling any office in the public service during the next three years.

In Bologna, to which the Austrians advanced, some efforts were made for the defence of that place, the seat of the provisional government; but they were so inadequate that the army entered without any opposition, and speedily all the other cities and towns surrendered except Ancona, where the members of the temporary government had fled for refuge. In their flight they had taken Cardinal Benvenuto, and carried him with them as a hostage or a prisoner. As the Austrians advanced towards Ancona, and no prospect of escape for the revolutionary leaders presented itself, the leaders of the insurgents pressed the cardinal to enter into a treaty, by which an indemnity should be given to all political offenders on condition of surrendering the city and the citadel. He at first refused to enter into any negotiation; but at length, under a protest that he had no power to do so, he signed a treaty to the effect proposed, and the city immediately submitted to its former sovereign. The same submission must have been made in twenty-four hours to the Austrians, and the pope refused to ratify the cardinal's stipulations.

Legal proceedings were then instituted against all such of the insurgents as had signed the act of the provisional government which had declared the abolition of the temporal power of the pope, broken their oaths of military obedience, or published irreligious or seditious writings. Several were tried and condemned to different degrees of punishment, but not a single life was sacrificed. It was said that this mitigation of punishment was adopted at the suggestion of the French ambassador at the court of Rome. That minister could not, however, feel much satisfaction at an apologetical paper put forth by the provisional government immediately before its dissolution at Ancona. In that manifesto they stated, "that a principle proclaimed by a great nation, which had solemnly promised not to permit its violation by any European power, and the declaration of guarantee given by a minister of that nation, had induced them to give their assistance to the movements of the people in the several provinces."

Within six weeks from their commencement, all the disturbances in Italy were quieted, and the Austrian troops had been withdrawn to their own territory. In the papal dominions, however, there was much confusion, owing principally to the undefined limits of the power of different constituted authorities. These had caused partial revolts, and the miserable papal troops were incapable of suppressing them. His holiness applied to Austria for some troops, which entered his dominions, and enforced submission. This movement had been notified to the French ambassador, whose answer left no apprehension on the part of that power; and therefore great surprise was excited when, about a month after, a French fleet, with an army on board, appeared before Ancona, and by a fraudulent attempt succeeded in seizing upon that city with its citadel, driving out the pope's troops, and exercising many excesses towards the inhabitants. This transaction occurred in February 1831. It led to some detailed negotiations, which at last were settled by a treaty on the 16th of April. By it the French were to remain in Ancona, but no reinforcements were to be sent to them. The general who had made the capture was to be recalled. The troops were not to go beyond the walls of the city, they were to be maintained wholly at the expense of France, they were to interfere in no internal affairs, and were to depart as soon as the pope should have no longer occasion for the assistance of any Austrian forces. In this equivocal situation, the French troops at present occupy one of the best ports in the Adriatic Sea. It is not the business of a work of this kind to enter into speculations on the motives which for the last four years have influenced the king of the French in his conduct regarding Italy.

Having thus sketched, with as much detail as the limits of this work will allow, the history of Italy from the time when the dissolution of the Roman empire took place to the present period, we must remark, that in compressing the events of fourteen centuries into a few sheets, it has been scarcely possible to do more than produce a chronicle rather than a complete history, and therefore the dates of the greater events only have been given, so as to be useful for the purpose of reference. The causes which led to these events, the characters of the great actors in them, and the effects produced by them, would have opened a wide field, which might have been explored with delight, but which would have encroached too much on the subjects required to be treated in this work.

We have, however, here pointed out the origin of the several states which now compose the land of Italy, and at what time and by what means they had attained their rank as sovereignties. The actual condition of these sovereignties will be found in their alphabetical order in this work; but the notices of the preceding pages on the history of Italy will be found sufficient to enable us to dispense with the minute historical details of each of the states that now exist.

Physical Condition.

We now proceed, therefore, to take a view of Italy as a whole, and to describe those physical circumstances common to it in that view.

Italy is bounded on the north-east by the Austrian provinces of Illyria and Tyrol, on the north-west by the cantons of Switzerland, and on the west, in a small part, by the kingdom of France. The southern part, however, which in shape resembles a boot, is surrounded by the sea, having on the north-east the Adriatic, on the south-east the Ionian Sea, and on the south and west the Mediterranean. Its sea-coasts are for the most part protected by lofty acclivities. On the north-east shore, however, an estuary is created by the mouths of the river Po, which form a kind of delta of swampy and marshy land, whose insalubrious atmosphere acts as a powerful protection against any maritime attacks.

The extent and population of the several states which compose the whole of Italy is shown by the following table, which includes the great islands of Sardinia and Sicily, and the smaller islands on the coast, but does not comprehend Corsica, which, though inhabited by an Italian race, forms at present a portion of the kingdom of France.

Name of the State.	Extent in Square Miles.	Population.	Capital Cities.
Kingdom of Naples	43,052	7,434,300	Naples.
Kingdom of Sardinia	29,534	4,123,000	Turin.
Austrian Lombardy	18,450	4,278,902	Milan.
Territory of the Church	17,572	2,592,329	Rome.
Grand Duchy of Tuscany	8,759	1,275,000	Florence.
Duchy of Parma	2,253	437,400	Parma.
Duchy of Modena	2,145	379,000	Modena.
Duchy of Lucca	434	145,000	Lucca.
Republic of San Marino	44	8,400	San Marino.
	122,243	20,673,331	

Thus Italy may be considered about the extent of Great Britain and Ireland, but as containing nearly three millions fewer inhabitants.

The face of the country is much diversified by lofty mountains. The most stupendous mass of these elevations, which forms the northern boundary, has been most fully described in this work in its proper place, under the article ALPS. The second range of mountains, the Apennines, runs nearly through the whole of Italy. These commence in the maritime Alps with Mount Appio, between Tende and Coni, at the southern point of Piedmont, in latitude 44. 12. north, where the pass of the Bochetta is formed. At first they take a direction to the north-east, and then trend to the south-east, and at length to the south-west, when they are lost in the Mediterranean Sea at Cape Passaro in Sicily, in latitude 36. 35. In Upper Italy the Apennines run along near the shore, and the foot of them is washed by the waves of the sea in the territory of Lucca, where they form the Gulf of Genoa. In Tuscany also they nearly touch the coast till they enter the papal dominions, when they run along the centre of the peninsula, and encompass the Abbruzzis and Molise, and pass through Basilicata and the two Calabrias, to the most southern part of Continental Italy. They pass under the straits to Sicily, where they spread over the eastern coast of that island, and are joined with the gigantic Mount Ætna, after which they vanish under the sea. The Apennines are covered with woods quite to their summits. Amongst the trees chestnuts especially abound, and the fruit of them is used by the natives as a most valuable substitute for corn during a great part of the year.

The Apennines in no case attain the elevation of the Alps, and have only a few very lofty rocky points, the highest of which are Gran Sasso, near Aquila, in the province of Abbruzzo, which is 8255 feet above the level of the sea; and Velino, which is 7870 feet. In winter the range is covered with snow, and it is somewhat late, especially on the northern sides, before it melts. The mountains thus furnish to the inhabitants an abundant supply of that indispensable luxury in a warm climate, ice.

A great uniformity is observable in the composition of these mountains, which consists chiefly of calcareous stones, though in the extreme north and south parts there are many variations, but in the centre there are no rocks of primary formation. They in many parts abound in tuffa; but the main range exhibits no specimens of volcanic matter, which are only to be seen on the south-eastern coast of Italy; Vesuvius, the extinct volcanoes of Nemi and of Albano, and the lava stream of Borghetto, not belonging to the Apennine range.

In their long progress through the greater portion of Italy these mountains send forth some remarkable shoots or spurs. To those on the west belong the Montagnolo and Montagnata, in the neighbourhood of Siena; the mountain Lora, near to Rome; and the rocky chain of Sorrento, which extends to Capri, in the Terra di Lavoro. On the east are the inferior ranges of the march of Ancona and of the district of Urbino, and especially the branch which projects between Acerenza and Venosa, and proceeds to Leccese, where it is lost in the sea, under which it probably proceeds, till it emerges from the water, and then continues to proceed through the Grecian ranges of Corfu and Arnauth.

Besides the Apennines, there are other mountains, which, though not far removed from them, yet manifestly do not belong to, and have no apparent connection with them. The most remarkable of these are the mountains of Sorriano and of Fogliano, near Viterbo; Sante Oreste, near Civita Castellana; Monte Cavo, between Frascati and Velletri; and the Volture in Puglia; all on the western side of the main range. Besides these, are the volcanoes, either active or now extinct, viz. Vesuvius. Capo de Monte, San Elmo, Camaldoli, Pausilippo, Solfatara, and Monte Nuovo. The most remarkable capes or promontories which surround the shores of the peninsula are, Martini delle Melle, Manara, and Mesco, on the coast of Genoa; Piombino and San Stefano, on the shore of Tuscany; Linara, Anzo, and Circello, in the territory of the church; Licosa, Palinuro, Felta, Surero, Zambrone, Vaticano, Armi, Sarta, Spartevento, Stilo, Nizzuto, Colonne, Saracino, Roseto, Volta, San Vito, Turco, Assinella, and Acquabella, on the shores of Naples. To these may be added the following in the island of Sicily, which are of great importance to all the navigators of the Mediterranean Sea, viz. Peloro, San Croce, Passaro, Scaramis, Granitula, Fero Voco, St Vito, Dell' Ursa, Gallo, Zassarano, Orlando, Carara, and Melazzo.

The northern division of Italy is copiously supplied with streams of water from those capacious reservoirs formed at the foot of the mountain ranges of the Alps. Those lakes are composed of water, partly arising from springs, but chiefly from the melted snow and ice of the lofty summits around them. These lakes are never frozen in the winter, but run in continual streams, and thus serve the constant purpose of irrigation as well as of internal navigation, till they disappear in the rivers which proceed to the sea.

The largest of these lakes, called Lago di Maggiore, or Lago di Lucarno, begins in the Swiss canton of Ticino, but soon enters Italy, and then, between the dominions of Sardinia and Austria, extends to Sesto. It is nearly fifty miles in length, and varies in breadth from five to eight miles. It is shallower than most of the other lakes, being in the middle not more than twenty-five feet deep. It is 750 feet above the level of the sea, and is fed by the river Ticino and twenty-six brooks. It contains in it the celebrated Borromean Islands, for a description of which see this work (vol. v. p. 16). Its water issues forth by the river, which retains the same name as at its entrance till it joins the Po. The Lago di Lugano is partly also in the Swiss territory, and is of less considerable extent, but of great depth. It is about twenty-four miles in length, and from two and a half to six in breadth. Its surface is 870 feet above the level of the Mediterranean Sea. It receives the water of forty-three brooks or rivulets, and discharges it partly by the river Tresa into Lago Maggiore, and partly by means of an artificial canal into the small lake of Piano, a little to the eastward.

The lake of Como, celebrated for the romantic beauty of its borders, is wholly in Italy. It is about thirty-five miles in length, and in no part exceeds three miles in breadth, but it is of very great depth. It is formed by the river Adda and 195 smaller streams. It issues forth by the river, which bears the same name as at its entrance, but with an increased volume of water, and serves to fructify a great extent of land. At Bellagio it divides into two branches, one of which terminates at the city of its own name, and the other at Lecco. Lago d'Iseo is about twenty miles long and six broad; it is chiefly supplied by the streams of the Oglio, which issues from it again and runs to the Po. Lago d'Idro is small, being only seven miles in length, and through it the river Chiese passes before it joins the Oglio. Lago di Garda is the most extensive of all the lakes of Italy, covering a space of 315 square miles, or 201,600 English acres. It receives the water of the Sarta, and its only issue is at Peschiera, into the Mincio. It is of sufficient depth to carry vessels of the greatest draft of water. These vast reservoirs are of unspeakable advantage, both to the internal connection of one part of the country with the other, and to the several occupations of agriculture. As the slope of the land is regular and gentle from these lakes to the river Po, nature has thereby formed the means of distributing, with comparatively little cost of labour, the water over an extensive portion of the land, and in that due proportion which the nature of the soil or the description of the crop may require. In many parts streams of water are made to pass rapidly over the fields that require it, and what is not absorbed by the earth is received again into canals, and, at lower elevations, again passed in a similar manner over other fields, till the surplus fluid at length reaches the river Po.

As these modes of disposing water to the greatest advantage are almost peculiar to Upper Italy, and by their extension have been productive of the most beneficial effects on the fruitfulness of the soil, as well as on the internal communication, a sketch of their commencement and early progress can scarcely be destitute of interest.

After the decline of the power of the German emperors of the Saxon race, who had succeeded to Charlemagne, several free states were formed, of which Milan became one of the most flourishing; but war having been kindled amongst these states, most of the others combined with the Emperor Frederick I. against Milan, and, in 1162, captured and almost destroyed the city, laying waste the fields; but, during the continuance of hostilities, a change of fortune favourable to Milan, and the gaining of a battle, led to a peace in 1176. The energy and industry which this free state had displayed in war became equally manifest in peace. The canal then, as now, called Naviglio Grande, was begun to be constructed in 1178, or rather perhaps restored, for it is probable that the citizens of Pavia, eighty years before, had dug the canal, which had been partly filled up and rendered altogether useless during the continuance of hostilities.

The canal was at first only carried to Abbiategrasso, but the benefit was found to be so great, that, in the year 1220, the canal of Muzza was added to it. In 1269 the canal of Vettabbia was extended and lengthened. It had been originally constructed in 1037, but, as is stated by Giuleni (*Storia di Milano*, vol. iv.), was long neglected. In 1350 the canal of Treviglio, or Fosso Bergamasco, was begun; and, in 1460, the Duke Francesco Sforza first planned that of Artesana. These, though in some degree designed for the purposes of navigation, were chiefly planned and regulated to administer to irrigation. Navigation was only permitted two days in the week, and the other five days the water was used to enrich the land. It seems very probable that advantage to the soil from irrigation was known prior to any of the dates here stated as the commencement of these canals. That some progress was made as early as the year 1138, appears from a contract made in that year by the monks of Chiaravalle and Vicoboldone, in which are the following conditions: "*Ut monasterium possit ex Vectabia trahere lectum* (a canal) *ubi ipsum monasterium voluerit, et si fuerit opus liceat facere eidem monasterio fossata super terram ipsius Johannis* (the vender), *ab una parte viæ et ab alia, &c. possit firmare et habere clausum* (sluice) *in prata ipsius Johannis.*" A similar contract of the following year, and several of subsequent dates, are still in existence. The whole water of the Vettabbia belonged to those monks, having been granted to them by a charter of the Emperor Frederick II.; and the fame of their skill in the management of water was so great, that the chief of Milan, Napoleone della Torre, intrusted to their care the construction of works for draining the environs of that city, whilst Rinaldo, archbishop of Cologene, employed them in improving the marshes in his dominions. These ecclesiastics confined their attention and labours exclusively to irrigation, and did nothing for navigation; but they were the first to introduce the practice, since become so extensive, of selling their water by the hour, the day, or the week, and are said to have gained to their convent 60,000 partiche, or about 10,000 acres, of the best meadow-land in Italy.

Progress in the conducting of water must have been made in Italy centuries before the subject had attracted attention in the other parts of Europe. The learned Frisi, in his work (*Nuova Raccolta d'autori che trattono del moto della aqua*), speaking of the canal of Muzza already noticed, says that it was planned with the most perfect skill, and formed a masterpiece of art. The canal of Martesana is still seen with surprise. It receives its water from the Vaprio and the Adda; is carried between stone walls five Italian miles, on a level twenty-five feet above the bed of the Adda, parallel to it, in order to preserve the level; and distributes its water to the fields, which it could not otherwise reach without great labour and expense.

The subsequent progress of the management of water, and its beneficial application to agriculture, belongs more properly to the description of Lombardy, where it will, under that head, be found, than to the more general subject of Italy; but the early state of that art belongs to the history of the first dawn of a useful practice in the peninsula taken as a whole.

The north of Italy, as may be gathered from the description of the lakes, abounds in rivers. The principal of these is the Po, which conveys to the sea the water of most of the other streams. It originates in Mount Piso, in the Alps, and takes an eastern direction through the great valley of Lombardy, till it enters the Adriatic. The whole length of its course is about 330 miles, but for the first eighty miles it is scarcely more than a brook. The rich plain that is watered by it and by its tributary streams is 330 miles in length and 170 in breadth, and consists of the greatest extent of highly fertile land that exists in Europe. The course of the stream is very rapid, the water running at the rate of more than four miles an hour. A vast quantity of mud and other substances is brought down by this great force of the water to the lower part of the river, and being there deposited, tends to raise the bottom; and though the effect is in some degree mitigated by throwing up the substances on the banks, and thereby forming strong dykes or embankments, the bottom of the river has in many parts become higher than the land on both sides of it.

Though much labour and expense are applied to preserve the embankments, yet, when the snow and ice on the Alps melt suddenly, great inundations are experienced. The chief tributary streams which contribute to form the mass of water of the Po fall into it on the left bank. These are the Agogna in the dominions of Sardinia; the Ticino, the boundary between Sardinia and Austria; and the Adda, the Oglio, and the Mincio, in Austrian Lombardy. The water which increases the Po by its right banks are the streams of the Tanaro, the Trebbia, the Oreglio, the Arda, the Taro, the Parma, the Ena, and the Secchia. The next considerable river of northern Italy is the Adige or Etsch, which comes out of the Tyrol, passes Trent and Verona, and enters the Adriatic a little to the north of the mouths of the Po. It does not in summer discharge much water, and is only navigable a short distance higher than Verona.

Central Italy does not abound in rivers, and most of them are of short courses. The most considerable is the Arno, which rises in the Apennines, at the foot of Mount Falterone, runs through Tuscany, and enters the sea near Pisa. It is navigable for small craft, but the chief interest it excites arises from the rich and beautiful valley which is watered by it in its passage to the sea. The rivers which rise in the Apennines and run to the eastward, are for the most part mountain streams or torrents, occasionally dry, and, except when the ice and snow melt, contributing but in a small degree to augment the waters of the Adriatic.

The south of Italy contains few rivers deserving the notice they have received. The Tiber, in the papal state, descends from the Apennines, not far from the source of the Arno, and continues a course of nearly 150 miles, in which it passes Rome, and enters the sea about fifteen below that city. It is turbid, rapid, and deep; but at Rome does not exceed a hundred yards in breadth, and is only navigable from the sea to that city. The only other river in that territory is the Pescara, which runs into the Adriatic.

The Neapolitan dominions, though abounding in brooks and rivulets, which are valuable to the agriculturist, and with mountain streams, sometimes swelled into torrents, and at other times nearly destitute of water, has few streams of any length. The most important of them is the Ofanto, running eastward to the Gulf of Manfredonia, the Basiento, the Salandretto, the Agri, and some others; all of which empty themselves into the Gulf of Taranto. Those which run to the westward are the Garigliano, emptying itself into the Bay of Gaeta, the Volurno, and the Silaro. None of these are navigable, and their mouths are for the most part surrounded with swamps, which generate malaria, and are highly injurious to human life.

In a country extending from north to south through ten degrees of latitude, there must be a great difference of climate from the position alone; but besides that, the climate of Italy is influenced by the proximity of lofty mountains in some of its divisions, and by the influence of the air from the sea, which almost surrounds the other parts. If we follow the classification of Saussure, we may divide the climate of Italy into four regions. The first extends from latitude 46. 28. to 43. 30., and thus comprehends the whole of the Austrian and Sardinian dominions, and the other territories to the north of the Apennines, with the legations of Bologna, Ferrara, and Romagna. In this region the quicksilver in Reaumur's thermometer descends to 10 degrees below zero; the lagunes at the mouths of the rivers are frozen; and sometimes in January and February the snow remains from ten to fourteen days on the ground. Delicate plants do not grow except in sheltered situations; but the mulberry trees flourish, and rice is grown. The slight night-frosts appear in November, and some years as late as April. Even in summer a benumbing cold is brought down from the Alps, by a violent storm of northerly wind. The second region extends from 43. 30. to 41. 30. comprehending Tuscany, Lucca, the papal states, the Abbruzzis, and the whole of the western shore to the south of the Apennines, though some part of the latter does extend as far north as 44., but, from being sheltered by the mountains, has a climate similar to the southern part. This is the appropriate climate for the growth of the orange, the lemon, and the olive; but, even in this region, the snow is occasionally to be seen on the fields. The third region extends from 41. 30. to 39., and comprehends the greater part of the continental dominions of the kingdom of Naples. Here snow is rarely seen, and never remains; and the quicksilver seldom falls below three degrees, and all plants of the agrumenous tribe flourish in the open air. The fourth region extends from 39. to 35. 50., and comprehends the southern part of Calabria, and the island of Sicily. The quicksilver rarely falls below zero, and snow and ice are unknown except on the summits of the mountains of Ætna and Sila. The tropical fruits come to perfection in the open air, the sugar-cane flourishes, the cotton plant ripens, the date trees are seen in the gardens, and the enclosures of the fields are formed by aloes. It will be obvious that this classification cannot be universally applied, and principally attaches to the flat land of Italy. Thus the positions on the sides of high mountains, the vicinity of the sea, and the volcanic nature of the soil, all have an influence which must cause many local variations in any classifications, and form exceptions to what is generally correct. The tops of the Alps in Savoy and Piedmont are covered with perpetual snow. The Apennines are commonly clothed with it from the middle of October till the beginning of April; and on the highest mountains of Abbruzzo, the Majella and the Velino, it remains from September till May. The northern part of Italy, including Tuscany and the papal states, does not generally present that charming aspect which people from the north picture to themselves of the garden of Europe; and they are only introduced into that region on proceeding to the east from Manfredonia, or to the west from Terracina. There the winter is scarcely colder than our September; vegetation proceeds without interruption; and the air is filled with the most aromatic odours.

The climate of Italy, represented, as it frequently is, in the most glowing colours, is not without great and serious annoyances and inconveniences. There prevails from May to September a burning heat; the sun, with its perpendicular rays, threatens to destroy every vegetable; this burning atmosphere produces a brown landscape, unrefreshed by a drop of rain; when the air of the cooling sea breezes is scarcely perceptible, or is so changed as to bring with it from the shores of Africa only a thick, damp steam, whilst a subterranean heat glows perpetually under the volcanic soil, and periodically sends forth noxious vapours injurious to the health of men and of beasts, and which have tended to produce depopulation in many extensive districts. To these evils may be added the annoyance produced by numerous swarms of insects, which fill the air, visit the dwellings, and are a constant source of vexation. The vast lagunes at the mouths of the great river, the Pontine Marshes, with similar swamps on the sea-coast, and in many other parts, tend to generate miasmata, that shorten human life, and are among the causes that the proportion of deaths to the whole number of inhabitants is greater in Italy than in any other division of Europe.

The inhabitants of Italy are a mixture of races, compos-

Religion and Learning.

ed of Gauls, Germans, and Arabians, who at various but distant periods have immigrated into the peninsula, and mingled with the few aborigines, whose language they have expelled; and from it has been framed a speech, which by cultivation has attained a peculiar character, and become, notwithstanding its variety of dialects, a common bond of union. The language used by the best writers is nearly the same in every part of Italy; but that of the lower classes is so very different in the several divisions of the country, that those born in one can scarcely understand the conversation of the natives of the other. All the educated classes can comprehend and enjoy the writings of Dante, Petrarch, Boccacio, Tasso, and Ariosto composed in the Tuscan dialect.

In Italy the inhabitants universally adhere to the Roman Catholic church; or, if any differ from it, the number must be very inconsiderable, as there are no public celebrations of any other religious rites but such as are prescribed by that communion, except that the Jews in Venetian Lombardy, in Leghorn, in Rome, and in Ancona, have permission, but under some rigid restrictions, to establish synagogues. The foreign Protestants also may celebrate their rites in their own language, under the sanction of the ambassador or consul of their nation. The established clergy are very numerous, and said to amount to 500,000 persons, or one in forty of the whole population. The number of sees, which formerly exceeded that of the bishoprics in the rest of Christendom, has been greatly reduced, as well as the greater part of the monasteries, which once deluged the cities and large towns. The churches, however, still possess great riches, and are everywhere sumptuous in their decorations and ornaments, containing much of what is most magnificent and glorious in art, or most refined in taste, elegance, and beauty. The exterior of the churches is very imposing, and the ceremonies are performed with the greatest degree of pomp and solemnity.

The higher clergy possess great power, and all of them enjoy immunity for their persons and goods, and in most cases are freed from taxation. The secular priests are under the superintendence of the bishops, and the monasteries under the chiefs of their several orders. Though the extent of the influence and power of the church, and its universality, are the same as in Spain and in Portugal, its exciting cause and its associations are very different. In those countries the religion is a species of chivalry, originating in the idea of the conquests achieved over the Moorish Mahommedans, and combined with all the traditions on that subject; but in Italy it is chiefly to be traced to the progress made in the fine arts. It is associated with painting and statuary, with music and with architecture, and, as in Spain, has little connection with the moral feelings of integrity, chastity, temperance, industry, and the domestic relations. These virtues, where they exist, owe but little to the institutions of the church, of which they are unshaken though but feeble adherents. Confession and absolution are the substitutes for those virtues, and little beyond the value of those substitutes is inculcated in religious instruction.

In no part of Europe is the education of the humbler classes so neglected as in Italy, taken as a whole; for though some advances have recently been made in Lombardy and in Tuscany, and will probably continue, yet nothing is thought of or projected in the other territories, on the subject. The instruction of the poor is wholly in the hands of the ecclesiastics, and nothing can be worse conducted. It is a wonder to find a countryman that can read, and a handicraft workman in the towns that can write his own name is equally singular. The institutions for the higher kinds of education are also far behind those in the other countries of Europe. Amongst these are the colleges and lyceums, where the instruction is partial, and neither calculated to impress with taste, nor to excite freedom and extension of thought. The studies are directed to logic and some classics; but the sciences are neglected, as are the languages of other countries, their customs, their intelligence, and their modes of thinking and reasoning. Mathematics are scarcely known, but casuistry is sedulously inculcated. The *Collegia Ambrosiana* and the *Collegia Brera* in Milan form exceptions to the description here given, but in everything but classical literature they are far from being well conducted.

The universities where education is completed are sufficiently numerous, and mostly of ancient date in their foundation. They are, Salerno, founded in the year 1100; Bologna, in 1119; Naples, in 1224; Padua, in 1228; Rome, in 1248; Perugia, in 1307; Pisa, in 1329; Siena, in 1330; Pavia, in 1361; Turin, in 1400; Parma, in 1422; Florence, in 1443; Catania, in 1445; Cagliari, in 1764; and Genoa, renewed and extended in 1783; to which may be added that of Modena, which, after long neglect, has recently been re-established.

The dates of these institutions may serve to show the probable course of study originally introduced, when the works of the schoolmen and the casuists entirely engrossed the public mind. Some few improvements may have been ingrafted on these foundations, but they have been of little efficacy in exciting to study, or in forming a considerable proportion of enlightened scholars.

In almost every one of the cities of Italy there have been long-established literary and scientific societies, which have cherished and encouraged learning among their respective members. These were begun in the fifteenth century, and have multiplied and increased ever since. They have contributed, since the restoration of learning, to its preservation, and have been in a great degree the means of bringing the talents and industry of the scholars into public notice. They are too numerous to be even named here. One of the earliest, as well as the most celebrated, is the *Academia della Crusca* of Florence, which still exists, and had for its object the perfecting of the language, by which great renown has been gained. The most flourishing of these societies in the present day are the Imperial Institution of Milan, and the Academy of Sciences at Turin. The institutions for the promotion of the fine arts are numerous; they are in connection with schools, in which painting, sculpture, and architecture, are taught by competent masters. The most useful of these are at Florence, at Rome, and at Bologna.

Italy abounds in collections of books, and especially of manuscripts of great antiquity, and of high value. The libraries in general are, however, very deficient in works of modern literature and of science. The most distinguished of the libraries are that of the Vatican in Rome, the Ambrosian at Milan, that of St Mark in Venice, and those of the Magliabechi and the Medici at Florence. There are in every part of Italy museums of great value, and most of them are arranged in the most perfect manner. All of them are with the greatest liberality thrown open to the public, and are thereby made the common property of all nations. Each palace of the men of eminent rank, and each public building, is a cabinet of art; and each city boasts of its antiques or of its modern works of art. The most distinguished of the museums are those of Florence and of Naples. Picture galleries are to be found everywhere, and present to the inspector of them many of the finest specimens of that delightful art. The churches, too, are most abundantly graced, as well by their architecture as by the exquisite pieces which exhibit the skill of the painters or the sculptors. The greatest loss that Italy had to lament was the removal of the best works of art by the French invaders; but, fortunate-

National Character.

ly for the country, the events of 1814 and 1815 led to their being again restored to the several places which had been robbed of them. There are botanic gardens attached to most of the universities, and several in the vicinity of the larger cities; and there are astronomical observatories in Bologna, in Padua, in Milan, in Florence, and in Palermo.

The clergy have already been noticed; and in viewing the inhabitants of Italy generally, it is proper to advert to the class next to that body in rank, but superior to them in number. The nobility consists of a vast number of families, each member of which continues through all their generations to retain their titles, even though they may be destitute of wealth. In most of the dominions they have little or no influence as a body on the measures of the governments. In the papal states, in Sicily, in Sardinia, some patrician power exists, and some feudal rights are exercised, and in Genoa a shadow of their ancient dignity is retained; but in the other parts not even a shadow of power is to be found amongst them. They have the barren titles of prince, duke, viscount, marquis, or count. Many of them possess extensive landed estates, which are for the most part majorats, or strictly entailed on the eldest son, and many of these are said to be at present deeply mortgaged. As no provision is thus made for the junior members of such families, they commonly enter the church or the army, and sometimes, though rarely, obtain offices in the civil service of the government. Of late some of the nobility have directed their attention to agriculture; but none of them, except in Venice and in Genoa, have applied themselves to commerce. From the condition of this class, it is usual to find amongst them the whole of the family residing in the palace of the head of it, with their wives and children, if they have any. As money rent is not commonly paid for the estates, but the produce of these divided between the proprietors and their occupiers, the necessaries for the support of such families reach them directly; and, except for purposes of show or of luxury, very little money is necessary. Although some members of the noble families have devoted themselves to the promotion of literature, of science, or of the fine arts, yet the great body live in the silent enjoyment of their rank and property, or, when mixing in society, do so in those crowded but economical assemblies, where they can, with little interruption from plebeian intruders, enjoy the patrician feeling of their dignity. In such families, the foreigners that may be introduced to them do not receive, or in general expect to receive, any hospitable attentions; nor indeed is hospitality one of those good qualities by which Italians are distinguished in any of the ranks of life.

It is generally reported that the morals of this class have been gradually improving of late years, and that the practice of each married lady having her favourite lover or cicisbeo, after the birth of her first child, is rapidly disappearing. In regard also to gambling, it is said to have been practised to a less ruinous extent of late years than in former periods. One of the greatest, or at least most usual, gratifications of the people of this rank, is a box at the opera, where they most commonly attend in the evening, and where, enclosed by curtains, they can receive the visits of their friends, without interrupting the pleasures they derive from the representation and the music.

The burghers in the cities have now none of the power which they enjoyed in the many cities which were once denominated free. The municipal power is concentrated in the hands of the several governments; and, where corporations do still exist, they have no other right than that of presenting humble representations or suggestions on inferior and local subjects. The more affluent inhabitants of the cities, comprehending those of the legal profession, the bankers, the merchants, and the superior artists, amongst whom may be included the possessors of the smallest landed estates, are not numerous; but they mix more with strangers than the nobles, and have fewer national prejudices. They appear to know that all born beyond the Alps are not necessarily barbarians or semi-barbarians, and amongst them foreigners may find the best associates.

The lower class of the town population are in bad repute, both as to morals and instruction. They are represented as more acute than honest, and are reported to be only capable of being restrained from violations of life and property by the activity of a very vigilant police.

Whatever may be the faults of the Italian nation, one good quality is obvious; their ready assistance to suffering humanity. All the cities are filled with charitable institutions, wherein infants, the helpless aged, the diseased, and the destitute, find refuge and relief; but it must be acknowledged, that no country has more need of such institutions, for in none are there to be found so great a number of beggars, nor so numerous a body as, in all the cities, take little care for any thing beyond the passing day or even hour.

The greater part of the population of Italy is, however, to be seen in the country, devoted to the pursuits of agriculture. A few, a very few of them, are in circumstances of moderate affluence; a few more may be represented as in a state of comparative ease, enjoying a bare sufficiency to support life; but the great body, to whom all others bear a slight proportion, are in the most wretched condition. They are the occupiers of small portions of land, some of them not exceeding an acre in extent, and most of them less than four acres, where, in miserable hovels, barely sheltered, they labour in the fields, and subsist themselves and their families on half the produce of the land, the other half being delivered to the proprietor at the time of harvest as his rent. Their food, simple as it is, is far from being sufficient to keep them in a healthy state. They taste neither bread nor animal food. Their chief subsistence is called polenta, made from Indian corn, which is merely pounded and then boiled, no expense on account of the miller or the baker being incurred. This kind of meal, made to the consistence of hasty pudding, would certainly be an aliment sufficient to support life when the quantity could be adequately supplied; but, with the utmost parsimony during the whole year, the termination of it, as the next harvest approaches, often finds them utterly destitute, and with no other resource but beggary or starvation. This is the condition of the larger class of human beings in the north and middle of Italy; whilst in the south the lazzaroni of Naples are living proofs of the wretched condition of great numbers in that more fertile soil and more temperate climate.

The Italians as a nation, excepting, however, those of the lowest class, are a fine race of men. The men are well formed, rather slim than stout, but strong and agile, with a complexion, either from nature or from exposure to the sun, of a dark hue, with expressive countenances and dark sparkling eyes, and for the most part with black hair. Their gait is grave but not solemn, and their whole appearance is expressive of self-respect. The women have mostly narrow foreheads, black or dark-brown hair, large, brilliant, and expressive eyes, a beautiful nose, which, with the forehead, forms the elegant Roman profile; a small mouth, with lips rather swelling; a clear, white complexion, with slight red tinges showing through it, and a delicate but well-formed figure. But the lower classes, owing to their early marriages, their subsisting wholly on vegetable food, and the hard labour they endure, exposed to a burning sun, have their beauty checked before it has attained maturity, and rarely display any attractions.

A hasty or an unobservant traveller, in passing through Italy, may well be charmed with the scenery of the country, the magnificence of the cities, the clearness of the sky, and the mildness of the climate. He will see only what is admirable and exciting. The prospects on descending from the Alps, adorned as they are by lofty precipices, with their tops buried in snow, and their sides discovering waterfalls descending into the beautiful lakes below, are all of a kind to gratify the sense, as are also the odours exhaled from flowers; and the fruit-trees regale another sense at the bottom. On the plains, too, the beauty of the fields, surrounded with mulberry trees, having vines in elegant festoons, with their pendant fruit, trained from one tree to the next, the centre of the enclosure exhibiting heavy crops of corn, pulse, or culinary vegetables, all conspire to increase the delight. The excellence of the roads, the post-horses, and the inns, contribute their share to heighten the enjoyment. The appearance, too, of the cities, with their magnificent public edifices and their spacious private dwellings, though the streets may be narrow and crooked, presents a picture eminently calculated to convey to the beholder that feeling of pleasure which novelty usually creates in the mind. We have enjoyed these gratifications to the fullest extent; but, in the description here given, we have felt it a duty to look beyond the delightful surface, to view the interior of the land, the state of the several classes of society that inhabit it, and to communicate to the reader the most accurate view that could be produced after much careful investigation. If it be more dark and gloomy than it has been commonly drawn, it will not be found, by those who, like the writer, have examined and discriminated, to be unfaithful in the delineation.

In every country agriculture is the chief branch of industry, and this is eminently the case in Italy; but, from the formation of the land, and still more from its extending through ten degrees of latitude, it becomes difficult to take a general view of the state of cultivation. The cultivation of Savoy or Lombardy differs from that of Calabria as much as that of Massachusetts does from that of Carolina. In this work, therefore, the details of rural economy will be found under the heads of the several dominions into which Italy is divided; and in this place will only be noticed those results of agriculture which yield food, drink, or clothing to its inhabitants, or which form the basis of manufacturing industry, or the rudiments of foreign commerce. The cerealia form, as elsewhere in Europe, the chief aliment of the inhabitants; in Italy, however, the lower classes, who are the most numerous, subsist much on maize, which requires little preparation to render it fit for food. In some of the southern parts wheat is made use of by the same class, not in the form of bread, but in that of macaroni, which is manipulated with greater facility. It is made from a hard wheat commonly produced from the soil, or, in times of scarcity, imported from the countries on the Black Sea or the Sea of Azoph. Wheat and maize are, on the average of years, about equal to the consumption, but little or none can be spared for exportation; and in many of the ports are depôts of foreign wheat kept to meet the variations of seasons, or to be used as articles of commerce with other countries.

As Italy produces abundance of wine, and consequently needs neither beer nor corn-spirits, no barley is needed for these drinks, and scarcely any is cultivated. Oats are but little grown, but abundance of beans of various kinds is produced. Rye, the common bread-corn of the far greater portion of Europe, is only raised in a few spots in the very northernmost parts of Italy, where it is made into bread for the poor; whilst those of the higher classes there, as well as throughout the whole peninsula in the cities, make use of wheaten bread. Rice grows in many parts, in fact wherever there is a sufficiency of water to insure a good produce, at such a distance from towns as not to be injurious to the health of the inhabitants. It is a part of almost every meal in families in easy circumstances, but is scarcely used by the families who are in circumstances that require the practice of great parsimony. A great variety of lupines are used as food, especially in the soups. In some parts of the mountainous regions chestnuts are a substitute for corn as long as they last. Fruits are plentifully used, particularly melons and cucumbers, as food; whilst the cheapness of onions, garlic, tomatos or love-apples, and capsicums, render them valuable as condiments. It is singular that that useful vegetable the potato, which in the other parts of Europe has been so much extended of late years, has been but partially introduced into Italy; and, where it is cultivated, it occupies a very small proportion of the soil. Lettuces, asparagus, endive, artichokes, and several kinds of turnips and of carrots, are everywhere grown.

Animal food is far from being extensively used. The oxen yield in some parts excellent, in others very indifferent, meat. The mutton is neither good nor abundant. Swine furnish a plentiful supply during the winter months, but are chiefly to be seen as bacon or hams, and above all prepared as sausages, the fame of which latter has reached unto England under the name of the city Bologna, where they were early and extensively prepared. The large dairy farms in Lombardy, in which the cheese known by the name of Parmesan is made, furnish the most and the best swine's flesh.

The fisheries contribute largely to the supply of food in Italy, though, from the number of fasts still countenanced by the Catholic church, not sufficient for the consumption; and the deficiency is procured by commerce with the English, French, and Americans, who convey to the sea-ports the salted cod-fish from the banks of Newfoundland. Their own fisheries on the coast give much occupation; the most considerable are those for the tunny, a very large fish, and for the anchovy, a very small one. These are conducted upon a large scale by joint-stock companies, composed of almost the whole of the inhabitants of the parts of the coast where they are carried on. The lakes and the rivers also yield some, though not a great proportion, of that kind of food which ecclesiastical restrictions render indispensable.

The sugar-cane is cultivated in the south of Italy, and some is grown spontaneously; but it is found, that in point of strength, as well as of cost, the sugar made from it does not succeed in a competition with that substance when imported from the West Indies.

The products of agriculture are sufficient for the clothing of all its inhabitants; for though wool is neither good nor plentiful, yet hemp and flax are grown everywhere, are manufactured at home, and, from the nature of the climate, linen can be substituted for woollen dress during most of the months of the year. Some raw wool is, however, imported to supply the manufactures, and some cloths both from England and France, together with (in Lombardy) those from the other Austrian provinces, especially from Bohemia. Some cotton is grown on the southern divisions of Italy, but not sufficient to furnish materials for their very insignificant institutions of that manufacture.

The chief product of Italian agriculture is the silk. It is produced in every part, and much of it is converted into articles of dress or of furniture, where it is collected; but the chief production of it is in the dominions of the king of Sardinia, or of the emperor of Austria, whence the looms of England, Prussia, Austria, Russia, and Germany, are supplied. The value of this commodity exceeds that of all the other productions of Italy which are exported to foreign countries. It is still making, as it has made during the last eighteen years, a rapid advance; and the great increase which has taken place in the propagation of mulberry trees promises, as they arrive at maturity, to increase the quantity of raw silk to an extent which could not have been calculated upon twenty years ago. An enlargement on this important article of commerce would be out of place in this general account of Italy; and for further information on the subject the reader is referred to the articles LOMBARDY and PIEDMONT in this work.

An article of great importance, produced from the soil of Italy, which is used partly as food, partly employed in home manufactures, and extensively exported as an article of foreign commerce, is the oil of the olive tree. It is used as a substitute for butter in the south, is much appropriated to the manufacture of many kinds of soap, and is exported to England for the use of our various fabrics, chiefly those of wool, and as a luxury at our tables. The planting and watching costs but little labour or expense, and in a few years the income more than recompenses for the labour. The best olive oil is produced near Genoa, in Lucca, in Tuscany, and in Calabria; but it is plentiful throughout the whole of Italy, except in Lombardy and in Piedmont.

The wines of Italy are not very highly valued in other countries, and almost the whole that is produced is consumed at home. In the northern parts there is a degree of acidity unfavourable to the taste, and scarcely any of them are or can be preserved beyond one year. The vines are not so much grown in vineyards, as in the hedge-rows; and this, it is thought, injures the quality of the wine. In the southern parts the wines are of a more fiery quality, but are not much esteemed by foreigners. The names of them will be found under the articles TUSCANY, NAPLES, SICILY, and PAPAL DOMINIONS. The grapes are in some of the southern states dried into raisins, as an article of foreign commerce; but the whole is an insignificant branch of trade.

The minerals of Italy are of small amount; and though mines of gold, silver, and copper were once wrought, all of them are now extinct. It yields at present some alum in the Papal Dominions and the Neapolitan territory, some vitriol and antimony in Parma, and sulphur in the kingdom of Naples. In many parts marble is extracted, but the best is near Verona and Carrara; and alabaster is found in many of the mountains. The salt is furnished on the sea-shore, and some of it from saline springs, and is adequate to the consumption.

The foreign commerce of Italy, and the internal trade, as well as the manufacturing industry, are various in the different states, and are or will be noticed in their appropriate places in this work. It need only be said here, that the roads being good in Italy, the intercourse between the several states is kept up with great facility; and that the interchange of the commodities of one district with those of another is profitable to those trading classes generally who devote themselves to the occupation. (G.)

ITCH, a cutaneous disease, appearing in small watery pustules on the skin, and commonly of a mild nature, though sometimes attended with obstinate and dangerous symptoms. See MEDICINE, *Index.*

Itch-Insect. See ACARUS, ENTOMOLOGY, *Index.*

In speaking of the manner of finding these insects in the itch, Fabricius observes, that the failure of many who have sought for them has been owing to their having expected to meet with them in the larger vesicles, containing a yellowish fluid like pus: in these he informs us he never found them, but only in those pustules which were recent, and contained merely a watery fluid. We must therefore, he observes, not expect to find them in the same proportional number in patients who for many months have been afflicted with the disease, as in those in whom its appearance is recent, and where it is confined to the fingers or wrists. The cause of this difference with respect to the pustules may, he conjectures, be owing to the death of the insect after it has deposited its eggs. A small transparent vesicle being found, a very minute white point, distinct from the surrounding fluid, may be discovered, and very often even without the assistance of a glass. This is the insect, which may be easily taken out on the point of a needle or penknife, and when placed on a green cloth may be seen much more distinctly, and observed to move. But all this, we may observe, probably depends on some optical deception.

ITCHAPOUR, a town of Hindustan, in the Northern Circars, thirty miles south-west from Ganjam.

ITEA, a genus of plants belonging to the pentandria class. See BOTANY, *Index.*

ITHACA, in *Ancient Geography,* an island in the Ionian Sea, on the coast of Epirus, the country of Ulysses, with a town and port situated at the foot of Mount Neius. According to Pliny, it is about twenty-five miles in compass, and according to Artemidorus only ten; but it is now found to be seventeen miles long and four broad. See article IONIAN ISLES.

ITINERARY, ITINERARIUM, a journal of travels, or an account of the distances of places. The most remarkable itinerary is that which goes under the names of *Antoninus* and *Æthicus,* or, as Barthius found in his copy, *Antoninus Æthicus;* a Christian writer, posterior to the times of Constantine. There is another itinerary, called *Hierosolymitanum,* from Bordeaux to Jerusalem, and from Heraclea through Aulona and Rome to Milan, under Constantine. The word *Itinerarium* denotes a day's march.

ITIUS PORTUS, in *Ancient Geography,* the *crux geographorum,* so called from the difficulty of ascertaining its position. It would be endless to recite the different opinions concerning it, with the various reasons advanced in support of them. Three ports are mentioned by Cæsar, two of them without any particular name, viz. the higher and the lower with respect to the *Portus Itius.* Calais, Boulogne, St Omer, and Whitsand, have each in its turn had its several advocates. Cæsar gives two distinctive characters or marks which seem to apply equally to Boulogne and Whitsand, namely, the shortness of the passage, and the situation between two other ports; therefore nothing can be determined with certainty respecting the situation of the *Portus Itius.*

ITURUP, one of the Kurile Islands, on which the Japanese some years since made a settlement. The Russians attacked them in 1807, and returned with considerable booty to Kamtschatka, whence they had sailed with two vessels.

ITYS, in fabulous history, a son of Tereus king of Thrace, by Procne, daughter of Pandion king of Athens. He was killed by his mother when he was about six years old, and served up before his father. He was changed into a pheasant, his mother into a swallow, and his father into an owl.

ITZECUINTEPOTZOTLI, or HUNCH-BACKED DOG, a Mexican quadruped similar to a dog. It is as large as a Maltese dog, the skin of which is varied with white, tawny, and black. The characteristic mark is a great hunch which it bears from its neck to its rump. This animal abounds most in the kingdom of Michuacan.

ITZEHOE, a town of Denmark, in the province of Holstein, situated on the navigable river Stor, in a pleasant valley. It contains 513 houses, and about 4000 inhabitants, who carry on an extensive trade in corn, and fit out many ships for the Greenland whale-fishery. Long. 9. 26. E. Lat. 53. 56. N.

IULUS, a son of Ascanius, born in Lavinium. In the succession to the kingdom of Alba, Æneas Sylvius, the son of Æneas and Lavinia, was preferred to him. But he was, by way of compensation, made chief priest.

Iulus, a genus of insects of the order aptera. See Entomology, *Index*.

IVA, a genus of plants belonging to the monœcia class, and in the natural method ranking under the fourth order, *Compositæ*. See Botany, *Index*.

IVAHAH, the name of a canoe employed by the South Sea islanders for making short excursions to sea. It is wall-sided, flat bottomed, and of different sizes, varying from seventy-two feet to ten; but its breadth is by no means in proportion; for canoes of ten feet are about a foot wide, and those of more than seventy are scarcely two. The fighting ivahah is the longest, and has its head and stern considerably raised. The fishing ivahahs are from ten to forty feet in length; those of twenty-five feet and upwards occasionally carry sail. The travelling ivahah is always double, and furnished with a small neat house.

IVER, a town of the county of Buckingham, in the hundred of Stoke, eighteen miles from London. It stands on the river Colme, which turns several corn and some spinning mills. The population amounted in 1801 to 1377, in 1811 to 1635, in 1821 to 1663, and in 1831 to 1870.

IVES, St, a borough and market-town of the county of Cornwall, in the hundred of Penwith, 276 miles from London. It is a sea-port, on the west side of the bay of that name, on the Bristol Channel. The government is in a mayor, twelve capital and twenty-four inferior burgesses. It returns two members to the House of Commons, chosen by the householders. The inhabitants amounted in 1801 to 2714, in 1811 to 3281, in 1821 to 3526, and in 1831 to 4776.

Ives, *St*, a market-town of the county of Huntingdon, in the hundred of Hurstingstone, sixty miles from London. It is in a rich plain, through which the navigable river Ouse flows, and is a well-built town, with a good market on Monday. The inhabitants amounted in 1801 to 2099, in 1811 to 2426, in 1821 to 2777, and in 1831 to 3314.

IVISA, or IVICA, one of the Balearic Islands, in the Mediterranean Sea, belonging to the crown of Spain. Its inhabitants amount to 15,200. It is about sixteen leagues to the eastward of Cape St Antonia, on the coast of Valencia. Its figure is an irregular polygon, stretching from north-west to south-east twenty-eight miles, and being in breadth fourteen miles. Its capital, of the same name, forms a good port, and is very well fortified. It is well built, and contains, including the suburb called Marina, about 3500 inhabitants. It yields wheat, oil, wine, flax, hemp, figs, almonds, raisins, oranges, lemons, cotton, and esparto, which are exported; but its principal commerce is in salt, which is most copiously formed in the various salt lagunes which surround the coast of the island. There are yearly produced from 130,000 to 170,000 cwts. The inhabitants are more attached to fishing than to agriculture, and the greater portion of the men follow that employment, leaving the care of cultivation to the females, who are robust and industrious. The capital is situated in north latitude 38. 53. 16. and east longitude from London 1. 57. 56.

IVINGHOE, a market-town of the county of Buckingham, in the hundred of Cotslow, thirty-six miles from London. The town is pleasantly situated on the side of a hill, with an extensive prospect over a rich valley. The inhabitants amounted in 1801 to 452, in 1811 to 508, in 1821 to 551, and in 1831 to 573.

IVORY is the name given to the tusks of the elephant, and of the walrus or sea-horse. Each male elephant arrived at maturity has two tusks. These are extremely diversified in size, which depends principally on the age of the animal; they are hollow at their insertion into the jaw and for a considerable space therefrom, and always taper to an obtuse extremity. The colour externally is yellowish, brownish, and sometimes dark, but internally it is a cream white. The best tusks are large, straight, and light coloured, without flaws; not very hollow in the stump, but, on the contrary, solid and thick. The most esteemed are obtained from Africa, being of a closer texture, and less liable to become yellow, than those imported from the East Indies. The tusks of the sea-horse afford the hardest and whitest of all ivory. They are usually short, and very much curved; the thick end is hollow, as in the tusk of the elephant; a glossy enamel of extreme hardness covers the cortical part; and they vary in weight from three or four pounds to thirty. The horn or tooth of the narwhal, one of the cetaceous tribe, also consists of ivory, which is as hard as that of the elephant, and susceptible of a fine polish. The largest size is ten feet in length, and some inches thick at the lower extremity, forming a slender cone of a twisted or spiral figure. But its texture is in several respects different from that of other ivory; and there is a prejudice against the ordinary use of it amongst those who work in that material.

From the earliest times, the people of all the Asiatic countries, where the elephant is found, have had the art of taming the animal, and applying it to useful purposes; but no such art has ever been possessed by any African nation. Nor has this apparently been owing to any difference between the Asiatic and African elephant in point of docility; the real cause is probably to be found in the inferior intelligence and sagacity of the African people. Alexander the Great is believed to have been the first European who employed elephants in war. With regard to those made use of by the Carthaginians, it has been supposed, though with little probability, that they were mostly, if not wholly, imported from India, and that they were managed by Indian conductors, some of whom were captured by the Romans in the great victory gained by Metellus over Asdrubal. But, in the first place, the name of Indian, as used by the Romans, was so extremely vague, that no safe conclusion can be drawn from it; nor, even if the conductors were of that people, does it follow that the elephants had been brought from India. And, secondly, it is not reasonable to suppose that an active and enterprising people, like the Carthaginians, would have imported from a distant country, and at an enormous expense, an animal which, they must have known, was to be found in equal vigour and perfection in their own. On this subject, however, we beg to refer the reader to some learned and valuable notes in the *Ancient Universal History* (vol. xvii. p. 529, 8vo); and also to Buffon's article on the elephant, one of the most masterly pieces of composition to be found in his admirable work.

Ivory is applied to a variety of purposes in the arts. In England, the chief consumption of that commodity is in the manufacture of handles for knives; but it is also extensively used in the manufacture of musical and mathematical instruments, chess-pieces, billiard-balls, thin plates for miniatures, toys, and small works of vertù. Articles in ivory, however, are said to be manufactured to a greater extent, and with much more success, at Dieppe, than at any other place in Europe. But the art of working in this beautiful material is far better understood by the Chinese than by any other nation. No European artist has hitherto succeeded in cutting concentric balls after the manner of this people; nor have their boxes, chess-pieces, and other articles manufactured in ivory, been approached, far less rivalled, by any similar productions that are to be met with in other countries.

Ivory, in the rough state, is a very considerable article of commerce. The importation of elephants' tusks into Great Britain, for twelve years from 1788 to 1799 inclusively, amounted to 18,914 cwts. or, on an average, to 1576 cwts. annually. Since that period, however, the trade has much increased. The imports in 1831 and 1832 were, at an average, 4130 cwts., of which 2950 cwts. were retained for home consumption. But as the medium weight of a tusk is about sixty lbs. it follows that the yearly imports of 1831 and 1832 must be taken at 7709 tusks, and that, to obtain these, 3854 male elephants must have been destroyed. But, supposing the tusks could only be obtained by killing the animal, the destruction would really be a good deal greater, and must probably have amounted to 4500 or 5000 elephants. Occasionally, however, tusks are accidentally broken, one lost in this way being replaced by a new one; and a good many are also obtained from elephants which have died a natural death. Still it is obvious that the supply from these sources cannot be very large; and if to the quantity of ivory required for Great Britain be added that required for the other countries of Europe, as well as for America and Asia, the slaughter of elephants must, after every deduction, be immense; nor can it fail to excite surprise that the breed of this magnificent animal, and consequently the supply of tusks, has not been more diminished. The western and eastern coasts of Africa, the Cape of Good Hope, Ceylon, India, and the countries to the eastward of the Straits of Malacca, are the great marts whence supplies of ivory are obtained. The imports into Great Britain from Western Africa in 1831 amounted to 2575 cwts. whilst the Cape of Good Hope only furnished 198 cwts. During the same year, the imports from India, Ceylon, and other eastern countries, amounted to 2173 cwts. The price per cwt. duty (L.1 per cwt.) included, of elephants' tusks in the London market, in December 1833, was as follows:—

1st sort, weighing from	79 to 90 lbs. per tusk	L.29	0	0	to	L.31	0	0
2d do.	56 to 60	25	0	0	to	23	0	0
3d do.	38 to 55	23	0	0	to	26	0	0
4th do.	28 to 37	20	0	0	to	24	0	0
5th do.	18 to 27	18	0	0	to	21	0	0
Scrivelloes		14	0	0	to	35	0	0
Sea-horse teeth						5	0	0

(A.)

IVRY, a market-town of the arrondissement of Evereux, in the department of the Eure, in France, remarkable for the victory gained there by Henry IV. over the Duke of Mayenne in 1590. It is situated on the banks of the Eure, and contains about 1250 inhabitants, who are occupied in tanneries, and in twist spinning.

IVY. See HEDERA, BOTANY, *Index*.

IXIA, a genus of plants belonging to the triandria class, and in the natural method ranking under the sixth order, *Ensatæ*. See BOTANY, *Index*.

IXION, in fabulous history, the king of the Lapithæ, who, having married Dia, the daughter of Deionius, refused to give her the customary nuptial presents. Deionius in revenge took from him his horses; when Ixion, dissembling his resentment, invited his father-in-law to a feast, and contrived that the latter should fall through a trap-door into a burning furnace, in which he was immediately consumed. Ixion being afterwards stung with remorse for his cruelty, ran mad; upon which Jupiter, in compassion, not only forgave him, but took him up into heaven, where he had the impiety to endeavour to seduce Juno. Jupiter, to be assured of his guilt, formed a cloud in the resemblance of the goddess, upon which Ixion begat the centaurs; but having boasted of his happiness, Jove hurled him down to Tartarus, where he remains fixed on an ever-revolving wheel encompassed with serpents.

IXORA, a genus of plants belonging to the tetrandria class, and in the natural method ranking under the forty-seventh order, *Stellatæ*. See BOTANY, *Index*.

IXWORTH, a market-town of the county of Suffolk, in the hundred of Blackburn, seventy-seven miles from London. It is a neat town, with a market on Friday. The inhabitants amounted in 1801 to 827, in 1811 to 846, in 1821 to 952, and in 1831 to 1061.

JABESH, or *Jabesh Gilead*, was the name of a city in the half tribe of Manasseh, beyond Jordan. The Scripture calls it generally Jabesh Gilead, because it lay in Gilead, at the foot of the mountains which go by this name. Eusebius places it six miles from Pella, towards Gerasa; and hence it must have been to the eastward of the Sea of Tiberias.

JABLONKA, a town of the circle of Trentsin, in the Austrian kingdom of Hungary, celebrated for an extensive linen manufactory, containing 3580 inhabitants.

JABLONSKI, Daniel-Ernest, a learned Polish protestant divine, was born at Dantzig, on the 20th of November 1660. He commenced his studies at the gymnasium of Lissa, then attended the academical course of the university of Frankfort, and, after taking his degrees, visited Holland and England, in which last country he remained a year to hear the prelections of the Oxford professors. On his return he became successively minister of Magdeburg, Lissa, Köningsberg, and Berlin; and was at length appointed ecclesiastical counsellor, and president of the Academy of Sciences at Berlin. He took great pains to effect an union between the Lutherans and Calvinists, and wrote some works which are esteemed. He died in 1741. His works consist of, 1. A German and Hebrew Catechism, 1708, in 4to; 2. Sermons in German, 1718, in 4to; 3. The History of the *Consensus* of Sendomir, in Latin, 1730; 4. Different writings, in Latin and German, in favour of the Protestants of Poland, amongst which may be mentioned, Afflicted Thorn, or a Relation of what passed in that City since the 16th of July 1724, of which there is a French translation by Beausobre, Amsterdam, 1726, in 12mo, now very rare.

Jablonski, *Paul-Ernest*, was the son of Daniel-Ernest, and, like his father, entered the clerical profession, but distinguished himself much more in that of instruction, and particularly in the study of the oriental literature and antiquities. Born at Berlin in the year 1695, he received his academical education at the university of Frankfort-on-the-Oder; and such was his progress in the study of the Coptic, that he even surpassed his master, the celebrated Lacroze. In 1714, being then only twenty-one years of age, he obtained permission to travel, at the king's expense, throughout the greater part of Europe, in order to extend his knowledge of that language. He visited the rich libraries of Oxford, Leyden, and Paris, and made ample extracts from all the Coptic manuscripts which were then contained in these collections. On his return to his own country, he was appointed pastor of Liebenberg, in the Middle March, in 1720; professor of philosophy in 1721; ordinary professor of theology at Frankfort-on-the-Oder, and pastor of the Reformed or Calvinistic congregation of the same city, in 1722; and, not long afterwards, member of the Academy of Sciences of Berlin. This learned antiquary and orientalist died on the 13th of September 1757, after having published more than fifty works, of which a list may be found in the Dictionary of Meusel. Of these the principal are, 1. Disquisitio de Lingua Lycaonica, Berlin, 1714, in 4to; 2. Thirty-nine Letters full of erudition, in the *Thesaurus Epistolic. Lacrozianus*, tom. i. p. 163 et seqq.; 3. Exercitatio Historico-theologica de Nestorianismo, Berlin, 1724, in 8vo; 4. Remphah Egyptiorum Deus ab Israëlitis in deserto cultus, Frankfort, 1731, in 8vo; 5. Dissertationes Academicæ viii. de terra Gosen, ibid. 1735, 1736, in 4to; 6. De ultimis Pauli Apostoli laboribus a B. Luca prætermissis, ibid. 1746, in 4to; 7. Pantheon Ægyptiorum, sive de Diis eorum Commentarius, cum Prolegomenis de Religione et Theologia Ægyptiorum, ibid. 1750, 1752, in 3 vols. 8vo; 8. De Memnone Græcorum et Ægyptiorum, hujusque celeberrima in Thebaïde statua, ibid. 1753, in 4to, with figures; 9. Institutiones Historiæ Christianæ antiquioris, ibid. 1754, in 8vo; 10. Institutiones Historiæ Christianæ recentioris, ibid. 1756, in 8vo; 11. Remarks on the Canon of the Kings of Thebes, by Eratosthenes, inserted in the Chronology of Devignoles; 12. Different Memoirs or Extracts in the *Miscellanea Berolinensia*, the *Nova Miscellanea Lipsiensia*, and other periodical collections; and, 13. Opuscula quibus Lingua et Antiquitas Ægyptiorum, difficilia Librorum Sacrorum loca, et Historiæ Ecclesiasticæ capita illustrantur, magnam partem nunc primum in lucem protracta, edidit Jan. Gulielm. Te-Water, Leyden, 1804, 1813, in 4 vols. 8vo.

Of all the works of Jablonski, undoubtedly the most important is his *Pantheon Ægyptiorum*, and it is also the most complete treatise we possess on the subject to which it relates. For, although subsequent investigations, and monuments recently discovered, may have shed new light on different matters of detail, the estimation in which the work as a whole is held by the learned has not on that account been diminished. But, to peruse it with advantage, the reader should begin with the *Prolegomena*, which are commonly annexed to the second or third volume. Jablonski had commenced this work as early as the year 1720; and he is sometimes censured for having made no use of what appeared on the same subject in the interval between that year and the date of its completion. His own resources, however, were great; and although the general table at the end of the third volume occupies twenty-nine pages, some critics have found it of too limited extent in proportion to the variety of materials and the vast erudition displayed in the work. Jablonski is merely the translator into Latin of what relates to the worship of the sacred animals; he acknowledges, indeed, that this piece had been furnished to him by a lady of high rank, "matrona perillustris, non natalium magis et dignitatis splendore quam virtute incomparabili et raræ doctrinæ inclyta;" but he gives no information which can enable us to ascertain who this distinguished female really was. His treatise on the Memnon of the Greeks and Egyptians, and on the celebrated statue in the Thebaid, is a sort of sequel to the *Pantheon*, and, like it, is full of erudition. In his dissertation on the Egyptian god Remphah, worshipped by the Israelites in the desert, he proves, from Egyptian and Coptic monuments, what the very name of the god might have led him to infer, that Remphah is the same with the Sun, which, in Egyptian, is denominated Ra, Ré, and Phré. To the student of Egyptian antiquities, and particularly of Coptic, the *Opuscula* present many recommendations, not only as being a collection of valuable pieces, some of which had been published separately, whilst others had remained in manuscript, and all equally inaccessible to scholars generally, but also as containing the fruits of the author's mature labours, especially a valuable glossary of Egyptian words, whether found in the Bible or in the ancient Greek and Latin authors. The treatise on the Statue of Memnon has been translated into French by M. Langlés, who has inserted it, with several additions, in the second volume of his translation of the Travels of Norden. (A.)

Jablonski, *Theodore*, counsellor of the court of Prussia, and secretary of the Royal Academy of Sciences in Berlin, was also a man of distinguished merit. He loved the sciences, and did them honour, without that ambition which is generally observable in men of learning; and it was owing to this modesty that the greatest part of his works were published without his name. He published, in 1711, a French and German Dictionary; in 1713, a Course of Morality; a Dictionary of Arts and Sciences in 1721; and translated *Tacitus de Moribus Germanorum* into High Dutch in 1724.

JACA, a city of Spain, in the province of Aragon. It is situated at the foot of the Pyrenees, near the river Aragon, from which the province has derived its name. The situation is on a plain of fertile land, between two lofty sierras. There are in it considerable manufactures of cloths and baizes. It is a place of great antiquity, and of considerable strength; the walls, of ancient date, are flanked with towers, and the citadel attached to it is capable of considerable resistance. It contains 4000 inhabitants, and is in longitude 0. 41. W. and latitude 42. 29. N.

JACATRA, a district of the island of Java, formerly a kingdom, governed by its own sovereigns. It was subdued by the Dutch East India Company's troops in the year 1619, who have ever since retained possession of it as sovereigns by right of conquest. Since that period Batavia has been constituted the capital. The country is watered by several rivers, which, however, are little better than rivulets in the dry season.

JACK, in *Mechanics*, a well-known instrument, of common use for raising great weights of any kind. The common kitchen-jack is a compound engine, where weight is the power applied to overcome the friction of the parts and the weight with which the spit is charged; and a steady and uniform motion is obtained by means of the fly.

Jack, in nautical language, a sort of flag or colours, displayed from a mast erected on the outer end of a ship's boltsprit. In the British navy the jack is nothing more than a small union flag, composed of the intersection of the red and white crosses; but in merchant ships this union is bordered with a red field.

Jack is also used for a horse or wooden frame to saw timber upon; for an instrument to pull off a pair of boots; for a great leathern pitcher to carry drink in; for a small bowl that serves as a mark at the exercise of bowling; and for a young pike.

Jack-Daw, the English name of a species of corvus. See Ornithology.

JACKAL, in *Zoology*. See Mammalia.

JACOB, the son of Isaac and Rebekah, was born in the year of the world 2168, and before Jesus Christ 1836. The history of this patriarch is given at large in the book of Genesis. He died in Egypt in the 147th year of his age. Joseph directed that the body should be embalmed, after the manner of the Egyptians; and there was a general mourning for him throughout Egypt for seventy days. After this, Joseph and his brethren, accompanied by the principal men of Egypt, carried him, with the king of Egypt's permission, to the burying-place of his fathers, near Hebron, where his wife Leah had been interred. When they had reached the land of Canaan, they mourned for him again seven days; upon which occasion the place where they staid was called Abelmisraim, or the mourning of the Egyptians.

Jacob, *Ben Hajim*, a rabbi famous for the collection of the Masorah in 1525, together with the text of the Bible, the Chaldaic paraphrase, and the Rabbinical commentaries.

Jacob, *Ben Naphtali*, a famous rabbi of the fifth century. He was one of the principal masorets, and bred at the school of Tiberias in Palestine, with Ben Aser, another masoret. The invention of points in Hebrew to serve for vowels, and of accents to facilitate the reading of the language, are ascribed by some to these two rabbin; and said to be introduced in an assembly of the Jews held at Tiberias, A. D. 476.

JACOBIN Monks, the same with Dominicans.

Jacobins, the name assumed by a party or club at the beginning of the French revolution, composed of members of the National Assembly. The club held its meetings in the hall belonging to the Jacobin friars, and from the place of assemblage derived its name.

JACOBITES, a term of reproach, in England, bestowed on the persons who, vindicating the doctrines of passive obedience and non-resistance with respect to the arbitrary proceedings of princes, disavowed the revolution in 1688, and asserted the supposed rights of King James and his family.

Jacobites, in *Ecclesiastical History*, a seet of Christians in Syria and Mesopotamia, and so called, either from Jacob a Syrian, who lived in the reign of the Emperor Mauritius, or from one Jacob, a monk, who flourished in the year 550. The Jacobites were of two sects, some following the rites of the Latin church, and others continuing separated from that church. There is also a division amongst the latter, who have two rival patriarchs. As to their belief, they hold but one nature in Jesus Christ; with respect to purgatory and prayers for the dead, they are of the same opinion with the Greeks and other eastern Christians; they consecrate unleavened bread at the eucharist, and are against confession, believing that it is not of divine institution.

JACOBSTADT, a town of Russian Finland, and capital of the circle of Korsholm, stands on the sea-shore, and contains 218 houses, with 1250 inhabitants. Long. 22. 27. E. Lat. 63. 31. 8. N.

JACOBUS, a gold coin, worth twenty-five shillings, and so called from King James I. of England, in whose reign it was struck. There are two kinds of *Jacobus*, the old and the new; the former valued at twenty-five shillings, weighing six pennyweights ten grains; the latter, called also *Carolus*, valued at twenty-three shillings, and in weight five pennyweights twenty grains.

JACOTTA, a small town on the sea-coast of the province of Cochin. It is a fortified place, with a small harbour, where it is said St Thomas the apostle first landed from Africa. Long. 76. 1. E. Lat. 0. 14. S.

JACTALI, a town of Hindustan, belonging to the nizam, in the province of Hyderabad. Long. 79. 32. E. Lat. 18. 48. N.

JAEN, an ancient kingdom of the south of Spain, now forming one of the four portions into which the province of Andalusia is divided. The extent of this province is 268 square leagues, and its population amounts to 206,807 souls. La Mancha bounds it on the north, Cordova on the west, and Granada on the east and south. It is surrounded on every side by lofty mountains, which almost exclude it from intercourse with the surrounding provinces. Its surface is a constant alternation of hills and valleys; and as from the surrounding mountains innumerable rivulets issue, its lower levels of land are abundantly irrigated, and therefore highly productive, whilst the hills, from want of moisture, are barren, or yield little except some sheep pasture in the winter season, when the merino flocks, driven from the north, seek food in the southern provinces. It produces wheat and barley, but not sufficient for its consumption. It has abundance of oil, and a full supply of wine, and its fruits are exquisite and plentiful.

The principal river is the Guadalquivir, which runs through the centre of the province, and receives additions to its copious stream from the junction of the Guadalimar, the Jandula, the Jaen, and the Escobar. There are some mines of lead in this province, in which sometimes considerable quantities of silver are found. These mines were of some celebrity whilst the Romans governed Spain; and though the silver has been less sought for since the discovery of the mines of America, yet, for the sake of the lead, they are now carried on by the government, and furnish sheet lead, shot, and musket balls, to the southern part of the kingdom. The manufacture of earthen jars, called alcarrazas, for keeping liquors in a cool state in the warmest weather, is the most considerable production of Jaen that is sent out of the province; and they are much esteemed in every part of Andalusia. The celebrated university of Alcala la Real, founded by Cardinal Ximenes, still exists in this province, and is attended by a number of students in divinity. The biblical scholar recognises it as having been the scene of the labours of the editors of the Complutensian edition of the Old Testament. In this province is the celebrated field, called the Plain of Tolosa, on which, six centuries ago, the most sanguinary battle was fought that the history of Spain has recorded.

Jaen, a city of Spain, capital of the ancient kingdom of the same name, in latitude 37. 48. and now forming one of the divisions of Andalusia, is situated on the declivity of a mountain, between some lofty sierras, in a fertile and productive country, which yields some wine and abundance of oil, for which there are twenty-seven mills. It stands on the left bank of a small river, now of the same name, but called by the Moors Guadalbullon, which, after proceeding about six leagues beyond this city, falls into the Guadalquivir below Mengibar. The city is deemed very healthy. The situation being elevated about 1400 feet above the level of the sea, renders it temperate; and the sierras which surround it, by the breezes that descend from them, tend to refresh the air in the most sultry seasons. The inhabitants amount to about 9000, who are not distinguished by their industry; and the only manufactures that are carried on are those of leather and soap. It is a bishop's see; and the cathedral, of great antiquity, has no peculiar beauty to render it deserving of notice.

JAFFIERABAD, a town of Hindustan, in the province of Berar, twenty-four miles north from Jalnapoor. Long. 76. 36. E. Lat. 20. 17. N.

JAFFRABAT, a town of Hindustan, on the sea-coast of the Gujerat peninsula, on the banks of a shallow river. It was formerly a place of considerable commerce, but is now possessed by native chiefs. Long. 71. 31. E. Lat. 20. 53. N.

JAFNA, the capital of the district of Jafnapatam. It stands at some distance from the sea, but communicates with it by a river navigable for large boats, and which falls into the sea near Point Pedro. The town is fortified, and possesses a good citadel, which, though small, is exceedingly well built; but it was given up in 1795, after a short resistance, to the British troops. The situation is salubrious, and living is cheap; on which account many families have removed to this place from Columbo. The greater part of the inhabitants are of Mahommedan extraction, and are divided into several tribes, known by the names of Lubbahs, Moplays, Chittees, and Cholias. The foreign settlers are more numerous than the native inhabitants. There are manufactures of coarse cotton cloths, calicoes, handkerchiefs, shawls, stockings, &c.; and there are also many artificers, such as goldsmiths, jewellers, joiners, and cabinet-makers.

JAFNAPATAM is the name of a district in the northern extremity of Ceylon. It is considered as the most healthy and populous part of the island, as it escapes, owing to its maritime situation, the intensely hot winds which prevail on the continent. It is clear of woods, produces a variety of fruit and vegetables, and abounds also in poultry and game; whilst the tract that lies between Point Pedro and Jafna is favourable to the breeding of sheep. In the islands dependent on this district, namely, Delft, Harlem, Leyden, and Amsterdam, so named by the Dutch from their native cities, government has an establishment for breeding horses and cattle, for which the islands afford excellent pasture. The woods towards the interior, separating the district from the Candian provinces, are inhabited by a savage race of people known by the name of the Vadahs or Bedahs, who are supposed to be the ancient inhabitants of the country.

JAGEPOOR, a large straggling town of Hindustan, in the province of Cuttack, situated on the south side of the Byturnee River, which is here nearly half a mile broad. It is the chief town of a principality of the same name, and has a manufacture of cotton cloths. Here formerly resided an independent rajah, who, in the year 1243, repelled the Afghans from his territory, and, pursuing them into Bengal, laid siege to Gour, the ancient capital of that country. They were again totally defeated in the year 1263. We have no certain account of the time when this country fell into the power of the Mahommedans, by whom it was possessed until it was conquered by the Mahrattas. During the period of the Mogul government it was a place of some consequence, and the remains of several Mahommedan mosques and other edifices are still visible. In the year 1751 it was ceded to the Mahrattas, under whose government it has declined; but it will probably recover, since the province has been subjected to the authority of Britain. Long. 86. 35. E. Lat. 20. 50. N.

JAGERNDORF, or, in the Sclavonic, Karnou, a city of the Austrian province of Moravia, situated on the river Oppa. It is surrounded with high walls, contains two colleges, the castle of the Lobenstein family, and 538 houses, with 4590 inhabitants, who are occupied in manufacturing linen and woollen goods of various descriptions.

JAGERON, a river of Persia, which rises nearly 120 miles north-east of Casbin, and loses itself in a sandy desert after a course of 150 miles.

JAGGERNAUT. See Juggernaut.

JAGHIRE, a district of the Carnatic, now included in the collectorship of Chingleput. It extends northwards from Madras to the Pullicat Lake, southwards to Allumparva, and westwards beyond Conjeveram. It is about 108 miles along shore, and forty-seven inland in the widest part, containing altogether 2440 square miles. This territory was obtained in the years 1750 and 1763, from the nabob of Arcot, in return for services rendered to him and his father by the Company; and was rented to the nabob on renewed leases until 1780, when it was taken under the management of the presidency of St George. This territory was dreadfully ravaged by Hyder Ali in 1768, and in the war of 1780; and was left in a state almost desolate, with nothing to mark its former state but the bones of those who had been massacred, or the naked walls of houses, temples, &c. A destructive famine, which succeeded, completed the ruin of the country.

Jaghire, an assignment made in Bengal by an imperial grant upon the revenue of any district, to defray civil or military charges, pensions, gratuities, and the like.

JAGHIREDAR, the holder of a jaghire.

JAGO, Richard, an ingenious poet, was vicar of Snitterfield in Warwickshire, and rector of Kimcote in Leicestershire. He was the intimate friend and correspondent of Shenstone, who was his contemporary at Oxford, and also, it is believed, his school-fellow; he belonged to

University College, and took the degree of master of arts in 1739; and he was author of several poems in th fourth and fifth volumes of Dodsley's collection. He died on the 28th of May 1781.

JAGO, ST. See SANTIAGO.

JAGO, *St*, the name of several provinces, towns, and rivers of South America, which will be described under the heads of the several countries in which they occur.

JAGO, *St*, one of the Cape de Verde Islands. See VERDE ISLANDS, CAPE DE.

JAGRAAM, a town of Hindustan, in Delhi, belonging to the Seiks. Long. 75. E. Lat. 30. 47. N.

JAGUEER. See JAGHIRE.

JAGUEERDAR. See JAGHIREDAR.

JAHDE, a town of the circle of Neuenburg, in the duchy of Oldenburg, in Germany, on a navigable river of the same name, which empties itself into the sea about two miles below the town. It contains 307 houses, with 2160 inhabitants. Long. 8. 12. 43. E. Lat. 53. 20. 45. N.

JAHIL, a town of Hindustan, in the Rajpoot territories, in the province of Ajmeer, sixty-five miles west-northwest from Jyanagur. Long. 74. 38. E. Lat. 27. 9. N.

JAHJOW, a village of Hindustan, in the province of Agra, remarkable for two great battles fought near it; the first on the 8th of June 1658, in which Aurungzebe was totally defeated; and the last on the 19th of June 1707, between the son and grandson of Aurungzebe, in which the latter was slain.

JAILLIEU, a town of the arrondissement of La Tour du Pin, in the department of the Isère, in France, on the river Bourbre. It contains 420 houses, and 1620 inhabitants, who are employed in paper-making and in calico-printing.

JAINS, called by some JOINUS, a sect or rather race of Hindus, found in considerable numbers in different parts of India, particularly in the southern peninsula. They form a class of dissenters from the established faith of Brahminism, so generally considered throughout India as alone founded on an orthodox basis. They deny altogether the authority of the Vedas, regarded by the genuine Hindu as the holiest of books. They either disown, or sink into a subordinate station, all the grand objects of Hindu veneration. In their hypothesis concerning the origin of the world, they have adopted opinions which seem to partake of the character of atheism. They do not, like the followers of the Vedas, acknowledge any spiritual and eternal Being, from whom the universe derived its origin. The material world, as well as the minds of all men and animals, are held by them to be eternal. They refuse to acknowledge anything which is not, or has not been, the object of the senses. Upon this principle they deny the existence of any beings superior to man, and admit no objects of worship except men who have raised themselves by their merits to the rank of divinities. As, however, they set no bounds to the perfection which the human soul may arrive at, their most eminent saints and pontiffs (amongst whom they particularly celebrate Gomat Iswara Swami) partake almost of the attributes of supreme divinity. To this station, however, they are exalted, not in consequence of a virtuous life, or of benefits rendered to mankind, but of those excesses of absurd and extravagant penance to which, throughout all India, such sovereign merit is attached. They have three ranks of ascetics, whom they call *Yatis*. The first, called *Anuvrata*, can be attained only by him who forsakes his family, entirely cuts off his hair, holds always in his hand a bundle of peacock's feathers and an earthen pot, and wears only clothes of a tawny colour. The second rank, *Mahavrata*, requires that all dress should be abandoned except a mere rag to cover nakedness, and that the hair instead of being shaven off, should be pulled out by the roots. He who aspires still higher, and seeks to attain the third degree, or *Nirvana*, throws aside even rags, and remains entirely naked; he eats nothing but rice, and that only once in two days. The name is nearly synonymous with that of Deity, and he is held in nearly equal veneration with the priests and rajahs, whose images are worshipped in the temples. At Billicull, or Belligola, the residence of their high priest, they have a gigantic image of Gomat Iswara Swami, the foot of which is nine feet in length, so that the height of the entire statue cannot be less than fifty-four feet; and there is a similar one at Kurcul, near Mangalore. This worship of gigantic images is common to them with the followers of Buddha, whom they also closely resemble in their theological tenets; nay, Samana and Gaudma, the main objects of Buddh veneration, are enumerated by the Jains amongst the earliest and most venerated of their priests. On the other hand, they differ from them entirely in being divided into four castes, distinguished from each other by the same privileges and manners as amongst other Hindus. The Jains observe also similar penances, carrying them only to a greater extreme. They are also scrupulous to a still greater degree as to causing the death of any living thing, even the minutest insect. The strictest Jains, to guard against this danger, do not eat after sunset; they have always a small broom to sweep the ground before them, and never drink water unless strained through a cloth. The orthodox Hindus have ceremonies by which any involuntary offence of this kind may be expiated; but the Jains, not allowing the efficacy of these, have no means of relieving their soul from the burden of such a trespass. Like the other Hindus, they consider it as unlawful for the widow to marry again, but discourage the barbarous practice of sacrificing herself on the body of the husband. On the whole, it would appear, that whilst their doctrines and belief closely coincide with those of the Buddhists, their civil and social life is discriminated only by minute shades from that of the Hindus. They have a system of their own with regard to history, chronology, and physics, of which we need only observe, that its tenets are still more extravagant and absurd than those contained in the orthodox pages of the Vedas and Puranas. (See *Asiatic Annual Register*, vol. ix.; Dubois *on the Manners of the People of India*, Lond. 1817; Ward *on the History, Literature, and Religion of the Hindus*, Lond. 1817.)

JAIVER, a town of Hindustan, in the province of Delhi, situated on the east side of the Jumna, forty-three miles south by east from Delhi. Long. 78. 28. E. Lat. 28. 9. N.

JAJARCOTE, a town of Hindustan, tributary to the Goorkhali rajah of Nepaul. Long. 81. 30. E. Lat. 29. 39. N.

JAJGHUR, a town of Hindustan, in the province of Ajmeer, and capital of a district of the same name. It formerly belonged to the rajah of Odeypoor, from whom it was taken by Zalim Singh, chief of Kotah, about the year 1803. The surrounding district comprehends eighty-four villages and towns, twenty-two of which are inhabited by a race of plunderers called Meenas, who give only personal service for their lands. The fort of Jajghur is built on the top of an oblong hill, and consists of two walls with ruined bastions, each having a ditch, and the outer wall lying a considerable way down the hill. The town is large, well built, and fortified.

JALEMUS, in *Antiquity*, a kind of mournful song, used upon occasion of death, or any other affecting occurrence. Hence originated the Greek proverbs, *ἰαλεμου ὀικρότερος*, or *ψυχρότερος, sadder or colder than a jalemus; ἐις τους ἰαλεμους ἐγγραπτεος, worthy to be ranked among jalemuses.*

JALOFFS, or YALLOFFS, a warlike people inhabiting that part of Africa lying between Senegal and the Mandingo states on the Gambia. See AFRICA.

JAMADAR, an officer of horse or foot, in Hindustan; also the head or superintendent of the peons in the sewaury or train of any great man.

JAMAICA.

Jamaica.

Jamaica, called *Xaymaca* by the Indians, and St Jago by the Spaniards, is the largest and most valuable island in the British West Indies. It is situated between the parallels of 17° 35′ and 18° 30′ north latitude, and of 76° and 78° 40′ west longitude, being one hundred and sixty miles in length by forty-five in breadth, and containing 4,000,000 acres of land. It lies ninety miles west of St Domingo, the same distance south of Cuba, four hundred and thirty-five miles north of Carthagena on the South American continent, and four thousand miles south-west of England.

Jamaica was discovered by Columbus on the 3d of May 1494, whilst coasting along the southern side of the island of Cuba, during his second voyage to the western world. It was found to be densely peopled by Indians, who opposed the landing of the Spaniards; but a discharge of arbalets put them to flight, and the discoverer formally took possession of the island in the name of his sovereign. His stay, however, was short, and for eight years the natives were allowed to remain in tranquil possession of their own territory. In 1503 was effected the first European settlement in Jamaica, and this was the result of necessity rather than of choice. During his fourth voyage, Columbus was forced, by stress of weather, to seek shelter on the northern side of the island, where he saved the lives of his exhausted comrades at the expense of the vessels, by running the latter ashore at a point called St Ann's Bay. Here for twelve months he endured great hardships and privations. He despatched a small squadron to Hispaniola, or Cuba as it is now called, for succours; but the governor of that island was his mortal enemy, and mocked his sufferings instead of alleviating them. A body of Spaniards also threw off their allegiance to their commander, and seizing on ten canoes which he had been preparing, put to sea in them, with the intention of crossing over to Hispaniola; but a storm forced them back to Jamaica, where they committed ravages on the unoffending Indians, and made attacks on Columbus and his few but faithful followers. At length, however, the renegades, after suffering some loss in a battle, were permitted to return to their allegiance; and, on the 28th of June 1504, Columbus bade a final adieu to the shores of Jamaica, in vessels prepared for his relief. In 1509, three years after the death of the discoverer, Jamaica became the theatre of rapine, bloodshed, and every species of cruelty. It was placed at the disposal of the two governors of the Darien government, to make what use of it they thought fit, as an emporium whence provisions might be obtained, or a market from which slaves could be taken at pleasure to work in the mines. The rival governors vied with each other in making the most of the island and its unhappy inhabitants. A detail of the enormities committed would sicken humanity. It is sufficient to say, that they were not less aggravated than those perpetrated in other parts of the New World, at a period when crime was uniformly worked on a gigantic scale. The sanguinary reign of the two governors was put a stop to by Diego Columbus, the son of the great navigator, who appeared to assert his prior claim to rule in the island, which the council of the Indies adjudged to be his right. He despatched Don Juan d'Esquimel with seventy men, who formed a settlement at Santa Gloria. The seat of government was fixed on the banks of a small rivulet called Seville Nueva, where a splendid city arose, but of which no memorial now remains except the name. At first it received its designation from the stream on which it stood, but was afterwards called Seville d'Oro. The peaceably-inclined Indians sank unresistingly down to the condition of serfs and slaves to the white superiors, who now usurped the sole occupancy of the soil. The government of Don Juan d'Esquimel appears to have been as mild as it was unfortunately brief. During its continuance, however, the agriculture of the island was materially advanced. The sugar-cane, the vine, and European cattle, were introduced; and from the wool of the cotton tree, which was celebrated in commerce, fabrics were manufactured of a quality so fine as to prove a source of wealth to the Spaniards. But, in their avaricious search for the precious metals, this means of aggrandisement was comparatively neglected. The colony, however, continued to increase rapidly in wealth and importance, and was enabled to send off branches from the parent stock to other parts of the island. But improvement for a time suffered a retardation by the death of Diego Columbus in 1526. He was succeeded by Don Pedro d'Esquimel, who has been singled out from amongst other tyrants as a most uncompromising destroyer of the Indians; and his cruelties, added to those inflicted by French corsairs, called flibustiers, had nearly put a period to the prosperity of Jamaica. The Spaniards fled from these plundering attacks across the mountain range, on the further side of which they founded St Jago de la Vega, which soon rose to be a flourishing city. Meanwhile, the French flibustiers reduced Seville d'Oro to ruins in their attacks upon the Spaniards; for the wars between Henry of France and Charles V. were in part transferred from the Old to the New World. The native Indians, thus placed as it were between two fires, continued to suffer severely; and it is stated that in 1558 they had been entirely extirpated. By the junction of the crowns of Spain and Portugal in 1580, Jamaica came into the possession of the latter, and new energy was infused into the colony by the Portuguese who emigrated thither. The cultivation of sugar and other articles was prosecuted with energy; and the breeds of live stock which had been originally imported from Hispaniola increased so rapidly, that a considerable trade arose in provisions, land, and hides. Passing over two predatory inroads made by the English in 1605 and 1644, we come to the period when the British made a conquest of the island in 1655. By order of Cromwell, a considerable armament was fitted out for the conquest of Hispaniola, at the moment that hostilities were declared against Spain in Europe. The expedition was despatched under the command of General Venables and Admiral Penn; but the intentions of the English were frustrated by the vigilance of the Spaniards. To make amends, however, for the discomfiture, Jamaica was captured in May 1655, after having remained in the possession of Spain for a period of 146 years. For some time little progress was made, many of the Spaniards still retaining possession of the mountains, and causing annoyance to those in the plains. But after some years they were gradually reduced, notwithstanding occasional assistance obtained from Cuba. A more formidable attempt to recover the island was made by the Spaniards in 1658, but without success. Under its first governors, Jamaica became the head-quarters of buccaneers, who infested these seas, and derived untold wealth from the plunder of the Spanish colonies, and vessels laden with the spoils of the New World. A considerable proportion of the population consisted of outlaws, and soldiers and negro slaves likewise began to be imported by the British, whilst emigration from England on a small scale commenced. Charles at his restoration adopted various lenient and wholesome measures to stifle the feuds which existed between the republican and royalist parties, and held out every encouragement to new settlers. In 1662, on the accession of Lord Windsor to the chief authority, a municipal government was constituted, and other means adopted to secure subordination, peace, and justice to all. In 1664, a popular legislative assembly was established, and for sixty-four years it continued to check the encroachments of the crown, as well as to regulate the internal affairs of the island. In about fourteen years after Jamaica came into the possession of Britain, it exhibited a remarkable progress in commercial prosperity. Fifty-seven sugar works, forty-nine indigo works, forty-seven cocoa walks, and several salt pans, attested the enterprise and industry of the colonists. Cattle, sheep, goats, and tame hogs, were reared in great numbers; and attention had been turned to the cultivation of cotton, tobacco, arnotta, and other articles. The white population at this time exceeded 15,000. In 1684, the impolicy of slave labour became apparent, in a serious revolt of the blacks, which, however, was speedily suppressed; but the maroons or runaway negroes became exceedingly troublesome to the planters. Two serious calamities overtook Jamaica within the space of two years. The first was the destruction of Port Royal, by one of those sudden convulsions to which this region of the globe is so liable. With the exception of about two hundred houses of the fort, the whole town, with its vast wealth, was submerged by the overflow of the sea. The greater number of the inhabitants perished, and their dead bodies, floating in shoals in a putrid state about the harbour, occasioned an epidemic, to which three thousand individuals fell victims. This earthquake took place in June 1692; and, exactly two years afterwards, a formidable descent was made on the island by the French; but the militia gallantly repulsed the invaders. During the remaining years of the seventeenth century, no memorable events occurred in the annals of Jamaica. The earlier part of that which followed was marked by various attempts made to bring the supplies raised by the representatives of the people under the control of the crown; but without success. In 1727, the revenue bill passed through the House of Assembly, the required fund being L.8000 per annum; and that which has been termed the magna charta of Jamaica was passed, namely, that the laws and statutes of England, which had been introduced and acted upon, should be considered as part of the legislative code of the island for ever. Matters being thus arranged, the prosperity of the colony continued to increase, notwithstanding the annoyance given to the planters by the negro marauders. In 1760, there took place a desperate revolt of the Indians, which ended in the destruction of the greater number of the rebel slaves. The contest was characterised by acts of cruelty and barbarity, which rivalled the early atrocities of the Spaniards. Some were burned, and others, gibbeted alive, were allowed to be broiled to death by a tropical sun. The slaughter or transportation of about one thousand slaves made little impression upon the population, which rapidly increased. The energies of Jamaica were called forth on the occasion of the meditated attack of the combined fleets of France and Spain in 1782. But the victory gained by Admiral Rodney, on the 12th of April of that year, over the French squadron, preserved the island to the British crown. The Jamaicans showed their gratitude by erecting a handsome marble statue in memory of the hero who triumphed on that day. Along with the other colonies of Great Britain, both in the East and West Indies, Jamaica suffered by the imposition of heavy duties on the produce of the island when imported into England. In 1795, another alarming insurrection of the maroons took place, on account of the intemperate policy of Earl Balcarras, then governor of the island. This rebellion continued upwards of seven months, the war being carried on with savage cruelty on both sides; indeed excesses were committed by the whites, and means employed to subjugate the maroons, which tended more to exasperate than to bring them under control. Into the particulars of this intestine commotion it were superfluous to enter. The savages exhibited their deep hatred of the whites by all those methods of retaliation common to barbarous tribes. Without openly facing the military forces which were sent against them, they lay in covert, and, whenever an opportunity presented itself, surprised them by unexpected sallies. In the fastnesses of the mountains they found a secure retreat; and as the ordinary means of civilized warfare appeared inadequate to bring the contest to a speedy issue, the governor resolved to call to his aid the bloodhounds of Cuba. This bears the aspect of a harsh, but it finally turned out to be a merciful expedient; for it paralyzed the energies of the Indians, and terrified them into a general capitulation. Their lives were spared, but they were transported, at the expense of the island, first to Nova Scotia, and afterwards to Sierra Leone in Africa. The only other slave insurrection which threatened the well-being of the colony, was that which took place in 1831–32; and with this it is hoped that the servile or predial war which the island has so often been doomed to witness will for ever cease. By the slave emancipation bill the principal ground for dissatisfaction on the part of the black population has been removed; but a discussion of this subject, with the results of the measure, belongs to another part of the present work. Besides the destructive visitation already noticed, Jamaica has repeatedly been visited by earthquakes, although only on one occasion was serious injury sustained. The hurricane, that scourge of the western archipelago, has not passed innocuously over this island. One of these, which occurred in 1780, was particularly destructive, the loss of life and property being both very great on that occasion. Besides these evils, the diseases of this country are occasionally malignant; the yellow fever, in particular, has long been proverbially fatal.

Jamaica is somewhat of an oval shape, and its surface is more beautifully diversified by hills and valleys than that of any other island in the West Indies. An elevated ridge, called in the eastern and highest part the Blue Mountains, runs longitudinally from east to west through the centre of the island, and occasionally rises to nearly 8000 feet above the level of the ocean. Other high ridges running from north to south occasionally intersect this chain. On the south they approach to the sea in gigantic spines, difficult of access, and covered with dense forests. On the opposite side the aspect of the country is very different. Instead of being rugged and abrupt, the hills are remarkable rather for their beauty than their boldness. They are of a gentle acclivity, uniformly rounded at the top with singular felicity, and commonly separated from each other by spacious vales and romantic inequalities. This gently-undulating surface is diversified with groves of pimento, luxuriant pastures, and all the exquisite verdure of the tropics. Viewed from a lofty eminence, the country presents an aspect of grandeur united with beauty, which can scarcely be surpassed. A splendid panorama of mountains appears towering up to the clouds, whilst, lower down, vast savannahs or plains clothed with various vegetation, vales, ravines, majestic woods, rivers, cascades, and mountain torrents, appear spread out before the eye of the spectator in all the beautiful irregularity of nature. The view of the island from the sea has also been celebrated by voyagers for its splendour. At Point Morant, the eastern cape of Jamaica, the scenery is magnificent. The Blue Mountains appear embosomed in a stratum of clouds, the rugged hills below being furrowed with ravines, and descending abruptly to the sea.

Upon a nearer approach, they are found to have their sides covered with black forests; whilst patches of bright green, and white houses, are descried on running along the south coast towards Port Royal. From Fort Nugent, which is conspicuous under a steep hill, to Port Royal, there is a narrow bit of land called the Palisades, composed of sand overgrown with mangroves, and studded with grave-stones. Behind this is the harbour of the capital; and Kingston is seen stretching over an extended level, and encircled by the loftiest ridge of the Blue Mountain chain. The heights of the principal mountains have been computed as follows: Blue Mountain Peak, 7770 feet; ridge of the same, 7163 feet; Portland Gap ridge, 6501 feet; Portland Gap, 5640 feet; Catherine's Peak, 4970 feet; with others of a lower elevation. It is stated, however, by some authorities, that the three very remarkable peaks on the grand ridge of the Blue Mountains, called Coldridge, have their respective summits 8184, 7656, and 7576 feet above the level of the sea, whilst other mountains of the same chain exceed a mile in height. The greater number of the mountains present a conical form, with steep but forest-clad declivities, approaching very near the shore on the north coast, and leaving plains of about twelve miles wide on the south. The dark and deep ravines between the lofty mountains, denominated cockpits, are closed in by dense woods, and present a striking contrast to the lower mountains, where coffee, pimento, cotton, capsicums, and other tropical vegetables, flourish luxuriantly.

Jamaica is abundantly supplied with water. Upwards of two hundred rivers have been enumerated; but, owing to the irregularity of the surface of the country, few of these are navigable for vessels of any burden. Black River, the largest and least rapid of these, flows through a level country, and is navigable by small craft for about thirty miles. The other chief rivers on the south side are Rio Cobre and Rio Minho; and on the north Marthabræ, White, Ginger, and Great Rivers. It is a striking fact, that in an island of such limited extent as Jamaica, there are no less than forty rivers varying from twenty to an hundred feet or more in breadth. They are all of great value, turning the mills and irrigating the plantations through which they flow, besides adding a beautiful feature to the landscape. The springs and rivulets are very numerous, but are unequally distributed. In some parts of the island seven or eight may be enumerated within the circuit of as many miles; whilst other districts are so far removed from water, that, for supplying their necessities, the inhabitants are obliged to have recourse to tanks and ponds. Several of the springs possess medicinal virtues. Two of a sulphureous nature, in particular, one hot, and the other cold, are celebrated as exceedingly beneficial in cutaneous diseases. With regard to harbours, the Jamaica shore has sixteen secure havens, besides thirty bays, roads, or shipping stations, which afford good anchorage.

The soil of this island is in most places deep and fertile. On the north side there is a species of red soil, the shades of which vary from a deep chocolate to a rich scarlet, and in some places approach to a bright yellow. What is denominated the brick mould is a deep, warm, yellow, hazel mould, reposing on a retentive under stratum. This is reckoned one of the best soils in the West Indies for the cultivation of sugar-cane. It is of great depth, easily laboured, and so inexhaustible as to require no manure. The black shell mould is the next in fertility, and this it owes to the mineral salts and exuviæ which are intermingled with it. The principal soils on the interior hills and mountains of Jamaica have been thus enumerated: A red clay, on a white marl; a red clay, on a grit; a reddish-brown clay, on marl; a yellowish clay, mixed with common mould; a red grit; a loose conchaceous mould; a black mould, on a clay or other substratum; a loose black vegetable mould, on rock; a fine sand; and the varieties of all the foregoing soils. The mountain land in general, when first cleared of its wood, possesses more or less a deep surface of rich black mould mixed with shells, a soil which will grow anything. Different parts of the island are characterised by peculiarities of soil, which are either those enumerated, or their varieties intermixed with different mineral or earthy substances. Silver and golden mica are frequently met with, and sometimes mistaken for the genuine metal. Amongst other mineral substances found, are mixed and purplish schistus, and the hard lamellated amianthus, which occurs in large detached masses, having all the appearance of petrified wood. White freestone, quartz of different species, and limestone, are abundant. Subcrystalline spar is found in small detached masses, and rock spar in blocks of great magnitude. A species of bastard marble, having a smooth even grain, is frequently used for limestone. There is a species of smooth clammy marl found, which is sometimes eaten by the negroes when they are diseased, to the detriment of their health. Lead ore, rich, and heavily impregnated with silver, striated antimony, varieties of copper ore, and iron-stone, which is attracted by the magnet, are found; but neither gold nor silver ore has yet been discovered, although the natives possessed these metals in abundance when the island was first visited by the Spaniards.

The climate of Jamaica is conformable to the latitude in which it is placed, but the heat is by no means so fearful as is usually represented. The highest temperature of course prevails in the low situations, those more elevated being colder, in conformity with nature's universal law. The climate of the island since its cultivation has undergone very considerable change. The medium heat at Kingston throughout the year is 80°, and the minimum 70°, of Fahrenheit. The latter is the maximum at eight miles from Kingston; and at an elevation of from 4000 to 5000 feet, the average range is from 55° to 65°, the minimum in winter being 44°, of Fahrenheit. The alternation of temperature is from eight to ten degrees on the south side of the mountains, and it is more so on the north; but the transitions are not so sudden and detrimental as in many parts of the continent of North America. The grand compensation for excess of temperature is afforded by the breezes which regularly every morning set in from the sea to the land, and every evening flow from the land towards the sea, as it were by a wise provision of nature, to preserve the equilibrium which the intense heat of the noon-day sun has disturbed. During the most sultry months, also, a succession of light, fleecy clouds continually cross the sun's disc, and thus, by intercepting his rays, mitigate their general ardency. It is cooler and more salubrious on the north side of the island than on the south, and the dwellers on the mountains enjoy a purer and more wholesome air than those resident on the low grounds. There is no striking variation of season, excepting what is occasioned by the alternation of dry and rainy weather. Thunder and lightning are prevalent, without being mischievous; and although the hurricane season ranges from July to October, severe storms at the windward Caribbee Islands are not experienced at Jamaica. The rains do not always take place in the same months; and in different parts of the island there is a considerable variation in the time of their commencement. In the mountains they are earlier, more frequent, and more heavy, than in the low country. In the latter, one district will have rain a month or six weeks sooner or later than another not twenty miles distant from it. What are called the spring rains sometimes do not set in till June, and even later; but occasionally they commence as early as March or April, which is always a great impediment to agricultural operations, this being the time for getting in the sugar crops on the north side of the island. The seasons vary much on either side. On the south, spring may be said to range from November to April, summer from May to August, and winter from September to October. On the north, however, winter ranges from October to March, and on this side there is a more plentiful supply of rain than on the other, but distributed in smaller and more frequent showers. It is, moreover, cooler, and has a vegetation of greater bulk and height. The spring rains are the most violent, and the atmosphere is then exceedingly sultry, and, being much charged with electricity, thunder storms are of frequent occurrence. The distribution of rain is sometimes very capricious, some parts being favoured with plenteous showers, whilst plantations divided from them only by a ridge of hills suffer from drought; and it often happens that, whilst the mountainous regions are visited by daily torrents, the low country is parched for want of rain. During droughts, however, vegetation is much assisted by the fall of dews. The climate of Jamaica is by no means so inimical to the human constitution as is generally represented, that is, provided those resident on the island live temperately. Fevers of various kinds are not uncommon; but the malignant epidemic, the yellow fever, has of late years almost, if not quite, disappeared from Jamaica and the other West India islands. Generally the climate has improved, and the high lands of this beautiful isle are well adapted to the European constitution, and they will be more especially so when they become cleared and cultivated. There are, besides, many districts in the interior where climate and soil are nearly as favourable to health as in any part of Britain; districts which are crown property, and at present lying waste.

Besides the vegetable productions indigenous to Jamaica, the island has been enriched with numerous exotics, the whole forming a vast and interesting catalogue of plants and trees, which our limits will not admit of our enumerating or describing in systematic detail. The forests abound with woods fit for various purposes, as building, mill-work, wheel-making, cabinet-making, dyeing, and so on. There are several species which, from their extreme hardness, cannot be used in cabinet-making, but are valuable for building and other purposes in which durability is principally required. Of these, the black and neesberry bully trees, the green heart, the rose-wood, and fiddle-wood, grow to a great height. The iron-wood, the nature of which tree corresponds with its name, does not grow to a great size, and is principally used for rough posts for the negroes' houses. There are various beautiful woods for ornamental cabinet work, of which the mahogany, the bread-nut-heart, and the satin-wood, are most highly esteemed. The mahogany tree is one of the most elegant in the island, and grows to from forty to fifty feet in height; but having been found a profitable article of exportation, the greater part has been cut down for that purpose, and there are not many trees now remaining on the island. The bread-nut tree is pretty abundant in most parts of Jamaica. Its wood is beautifully variegated, and takes a fine polish. The leaves are a nutritious food for horses and other animals; and the negroes find a substantial article of diet in the kernels of the fruit. The cedar grows to a great size, sometimes measuring thirty feet in girth near the root, and it is of proportionable height. The cotton-tree is the largest of all the trees on the island, but it is only used for making canoes, which are hollowed out from the trunks. The pimento is a highly valuable tree, and it flourishes spontaneously in great abundance on the north side of the island. This tree is celebrated for its beauty, and the leaves, when bruised, emit a fine aromatic odour, nearly as powerful as that of the spice itself. A single tree will produce one hundred and fifty of the raw, or one hundred pounds of the dried fruit. One of the most useful trees in the island is the bamboo, which is applied to numerous important purposes. The trumpet tree, which grows from thirty to forty feet in height, produces an agreeable fruit similar to our strawberry; its strong and fibrous bark is used for cordage, and its light trunk for bark logs, and the like purposes. One of the most curious trees is the mangrove, which takes root in the sands, and grows within the margin of the ocean. The coffee-tree is a handsome plant, and its fecundity is much improved by regular pruning. The coffee-bean is covered with a pulp, which when ripe assumes a fine crimson red. The cocoa-tree grows to the height of from fifteen to twenty feet, and bears its nuts in pods. The cultivation of this article is now neglected, not much more being raised than is necessary for the consumption of the inhabitants. The oil-nut tree (*ricinus*), which produces the castor oil, grows to the height of twelve or fifteen feet, and has a large indented leaf. It bears the fruit, which produces the oil, in clusters. There are two species of the cabbage-tree, the Barbadoes and the native cabbage-tree, the former being the most stately and beautiful. The cocoa-nut tree grows in great luxuriance, and abounds in every part of the island. Besides the above trees, Jamaica is plentifully provided with black and green ebony, yellow sanders, lignum vitæ, fustic, logwood, bitter wood, the valuable palmetto (sometimes one hundred and forty feet in height), and others. There is an abundant supply of the most delicious fruits, every month presenting a fresh collation. Amongst these may be mentioned the pine-apple or anana, orange, shaddock, pomegranate, fig, granedillo, neesberry, cashew-apple, kennip, spadillo, banana, mamee (a wild fruit), star-apple, sweet sop, musk-melon, water-melon, sweet melon, citron, avagato pear, several varieties of the mango, the chirimoya, akee, jack-fruit, bread-fruit, very fine grapes, plantain, plum, tamarind, olive, date, mulberry, as well as other delicious fruits. Amongst vegetables, potatoes, yams, cassava, peas and beans of every variety, artichokes, beet-root, carrots, parsnips, cucumbers, tomatoes, radishes, celery, choco, ochro, Lima bean, Indian kale, calalue, and various salads, flourish in abundance. Both maize and Guinea corn grow in great luxuriance in this island; and rice is capable of being raised in certain situations, but it is not an object of attention. Maize or Indian corn is universally cultivated, and it yields an almost incredible return; on an average, it is said, one thousand fold. Guinea grass, which abounds, is considered as of great importance, as the cattle that supply manure to the sugar plantations are fed by it. The various drugs, dye-stuffs, and spices, are of excellent quality. Aloes, cochineal, spikenard, canella, liquorice root, the castor-oil nut already noticed, vanilla, peppers, arrow-root, ginger, ipecacuanha, scammony, jalap, cassia, euphorbia, senna, and others, attest the fruitfulness and capabilities of the soil and climate.

But it is now time to advert to the grand staple plant of the island, the sugar-cane. The question which has divided inquirers into this subject, namely, whether the sugar-cane was indigenous to the Antilles, does not require to be discussed in this place. It seems certain that at an early period this valuable plant was extensively cultivated by the Spaniards in Jamaica; and in 1671 a writer speaks of the complicated sugar works scattered over the island as resembling towns or villages. There are several varieties of the sugar-cane, viz. the common cane of the island, the Bourbon cane (so called from its being brought last from the island of that name, though originally a native of the Society Islands), the transparent cane, the ribbon cane, the Batavian or purple cane, and the green stripe cane. Those chiefly cultivated are the Bourbon and transparent cane. The ribbon cane is also sometimes planted, on account of its hardy nature, though it yields much less juice than the other two. It is the most beautiful of all the species, being finely variegated with alternate stripes of crimson and pale yellow, whence it takes its name. The Batavian cane is in no estimation, being unproductive, and is only preserved as a variety. An idea of the extent of ground appropriated to the cultivation of the sugar-cane may be obtained from the fact, that for some years the importations into Great Britain have averaged, in hundredweights, 1,400,000, which, rated so low as a guinea per hundredweight, would give nearly one million and a half sterling. It is of very fine quality, and, by the improved systems of culture and manufacture which are coming into operation, there seems little doubt but that both the quantity and quality may yet be more extended. The quantity of rum made from the sugar is likewise very great. The average imports made annually into England may be taken at 3,500,000 gallons, which may be estimated in value at one million sterling. The next grand staple plant of the island is coffee. It was introduced into Jamaica in 1728, from which period the cultivation of it was extended, until about the beginning of this century, when it appears to have reached its maximum. This plant thrives in almost every soil about the mountains of Jamaica, and in the very driest spots has frequently produced abundant crops. The importation into Great Britain averages about 20,000,000 pounds yearly, which, estimated at the low rate of one shilling per pound, is another million sterling. Cotton, indigo, and cocoa, are not now so extensively cultivated as formerly, having given way to the foregoing staples of the island. The attention of the planters has recently been turned to other vegetable productions, particularly to the sun-flower, which, it is said, may be rendered valuable in a pecuniary point of view. Its fecundity in this climate gives it an advantage over corn for the common purposes of food for poultry, and when mixed with corn it constitutes a nutritious food for horses. The seeds also yield an oil, which, in the opinion of some, is preferable to olive oil. With respect to the other vegetable productions of Jamaica, such as flowers and flowering shrubs, there is little to demand particular attention. A few European flowers thrive, and there are a variety of others indigenous to the island, which flourish wild in the woods and mountain recesses. Here, even in winter, may be seen, what is often witnessed in the torrid zone, fruits and blossoms suspended at once from the same bough, the rivalship of Pomona and Flora.

Jamaica, like the rest of the islands appertaining to the new continent, when discovered, contained but few species of animals. Only eight varieties of quadrupeds are enumerated as belonging to it, viz. the agouti, peccari, armadillo, opossum, racoon, musk rat, alco, and monkey. The wild hog, the rat, and the mouse, seem now to be the only wild quadrupeds in the island. The wild hogs, which are larger and more fierce than the common kind, frequent the remote woods, and subsist on the fruits and roots with which these abound. The rats are most destructive animals, and their numbers and ravages are almost inconceivable. The island abounds with the feathered tribes remarkable for the brilliancy of their plumage, but there are only a few of them birds of song. Of these the most remarkable is what is termed the nightingale, a species of mock bird, possessing great variety, compass, and sweetness of tone. There are numerous species of the wild pigeon, and also of the parrot; and a variety of aquatic birds, as ducks, teal, coots, divers, and the like. In October the crane and the white galding (one of the heron family), come over in flocks from the island of Cuba. The plover, snipe, and ortolan, are also migratory. Within the last half century the quail has become a very common bird. But the most valuable of the winged inhabitants of the island is the black vulture or carrion crow, which is very useful in devouring all putrid matter.

The sea around this island, and the rivers by which it is watered, abound in excellent fish. There are also salt ponds, which, if properly attended to, might render the planters in a great measure independent of supplies of salt fish from Europe. The sprat, herring, dolphin, anchovy or silver fish, the flying, sword, sun, parrot, rock, king, and gar fishes, the flounder, sole, eel, bream, snapper, mullet, perch, boneeto, Spanish mackerel, sea-devil (weighing from 100 to 300 pounds), old wife, shark, porpoise, sting ray, thrasher, as well as many others, may be caught in abundance. Sea and land turtle are likewise plentiful, and of good eating. Some of the largest rivers contain alligators, but the chief harm which they usually do is the destroying of the fish, and devouring the poultry and pigs which come in their way. There are three species of snake in Jamaica, the yellow, black, and brown snake, the last being the smallest and least numerous of the three. None of these are venomous in their bite, at least to a serious degree. Several species of the lizard abound here, and scorpions and centipedes are common. There is a very troublesome insect called the cockroach, swarms of which infest every house; but the most annoying of these animals is the mosquito. There are numerous fire-flies, which display their harmless but vivid coruscations during the night. Bees are very numerous in the woods, and the honey which they produce is of an exquisitely fine flavour.

Amongst the animals useful to man, the ox may be placed first. Oxen, though generally smaller than those of England, are capable of performing a great deal of labour; and they are chiefly employed in those operations for which horses are used in Britain. The horses bred in the island are middle sized, hardy, and active, well fitted for the saddle or the harness, but not for the cart or plough, to which they are never yoked. The mules in Jamaica are far more hardy than the horses, and are consequently more valuable to the planter in assisting him in his operations. The sheep are very good, and the mutton is excellent, but high priced. Goats thrive and increase with little care, and the milk they yield is much superior to that of cows. For the most part the foregoing animals feed on the Guinea grass, and occasionally on the leaves of the bread-nut tree. Hogs are very plentiful, and their flesh is sweet and delicious. All kinds of poultry are raised here in great abundance, excepting geese and the common duck. But the Muscovy duck, the turkey, the Guinea fowl, and the common dunghill fowl, thrive and multiply wonderfully well.

Jamaica is divided into three counties, viz. Surrey, Cornwall, and Middlesex; and these are subdivided into twenty-one parishes. Surrey comprises seven parishes, has an area of 1,522,149 acres, and contains two towns and eight villages; Cornwall comprises five parishes, has an area of 1,305,235 acres, and contains three towns and eight villages; and Middlesex comprises nine parishes, has an area of 672,616 acres, and contains one town and thirteen villages. Kingston, the most considerable town in the island, and in reality, though not nominally, the capital, is situated on a gentle slope of about one mile in length, which is bounded on the south by a spacious basin, through which all vessels must advance beneath the commanding guns of Port Royal. The extended inclined plane, on the verge of which Kingston stands, is enclosed on the north by the loftiest ridge of the Blue Mountain chain, termed Liguana, which forms a semicircle, and terminates on the east at the narrow defile of Rock Fort. From this a long neck of land stretches to Port Royal, and forms the south barrier of a beautiful haven. On the west the semicircle terminates at a contracted pass, upon the edge of an impracticable lagoon, from which the main land sweeps round to Port Henderson, which, together with the projecting salt ponds, forms a natural harbour, where all the navies of Europe might anchor at once. The entrance is defended in such a manner as to render it altogether unassailable by sea. For nine miles around Kingston stretches an alluvial plain, surrounded by a series of irregular mountains, some of which have a considerable elevation. Kingston is principally built of wood; and the houses, which are generally two stories in height, have piazzas fitted up all round with Venetian blinds, or "jalousies," as they are termed. The streets, which are long, straight, and regular, incline gradually to the harbour, being intersected at right angles by some cross ones. There are several handsome private buildings in the West India style; the public offices are in some instances elegant; and the English and Scotch churches are spacious structures, particularly the former, which is built on a picturesque spot, commanding a splendid view of the city, the plains around it, the amphitheatre of mountains, and the spacious harbour of Port Royal. There are some good institutions here for charitable purposes, particularly the free school, the hospital, the lunatic asylum, and the asylum for deserted negroes. There are excellent stores for all descriptions of goods, and during crop time the wharfs present a busy spectacle, being crowded with buyers and sellers of all kinds of goods here trafficked in. Kingston contains about 30,000 inhabitants, and lies in longitude 76. 33. west, latitude 18. north. On a plain at the top of the declivity on which Kingston is built, are the fine barracks called Up-Park Camp. The camp covers an irregular square of between two and three hundred acres, sloping towards Kingston. The barracks consist of two long parallel lines of buildings, extending from east to west, two stories high, having a six feet basement, an excellent hospital, and a splendid bath. The whole cantonment is surrounded by a wall six feet in height, and surmounted by an iron palisading. Twelve hundred and eighty-four European soldiers are here comfortably encamped; and the attached offices are spacious, lofty, and commodious. A description of the other military stations may also be introduced here. Port Royal is situated nearly at the extremity of a tongue of land which forms the boundary of the harbours of Kingston and of Port Royal. A great part of the town of Port Royal is only a few feet above the level of the ocean, and the tongue of land towards the sea is frequently inundated. The royal naval yard lies to the north, the naval hospital to the south-west, and the works of Fort Charles and the soldiers' barracks to the southward. The fortifications are very strong, and the situation, though low, is healthy, from its exposure to the sea breeze. The harbour is capable of containing a thousand large ships with convenience. It was upon this spot that the former Port Royal stood when it was overwhelmed by the earthquake in 1692, and, with two thousand houses, was buried eight fathoms under water. On the shore opposite to Port Royal is Apostle's Battery, a small fort erected on a rock. Fort Augusta is a strong fortress, built upon a low neck of land or peninsula, joined to the hills at Port Henderson by a narrow isthmus of sand, having a coal formation for its base. The buildings of the fort occupy the whole area of the point of the peninsula. The barracks are two stories high, well ventilated, healthy, and generally contain four service companies. Stony Hill garrison is situated nine miles north of Kingston, on a ridge of mountains, about 2000 feet above the level of the sea. The barracks, which, generally speaking, are placed on small detached eminences, are capable of containing five hundred men; and as this post commands the grand pass which intersects the island from north to south, it is justly considered as of great importance. Port Antonio, situated at the extremity of the island, eighty miles from Kingston, is nearly insulated. The fort is a half-moon battery, with a magazine in the rear. The barracks are new, elevated, and commodious, but not capable of containing a great force. Marson Town is situated in the interior, between the parishes of Westmoreland and St James, on a very high mountain. The station is excellent, both in a military and a sanatory point of view; and the barracks can accommodate upwards of two hundred men. Lucea, or Fort Charlotte, is built on the north-eastern extremity of a peninsula, being bounded on one side by the bay and harbour of Lucea, and on the other by the sea. Majestic mountains rise immediately behind the town, about one mile from the garrison.

St Iago de la Vega, or Spanish Town as it is usually called, the capital of Jamaica, is situated at the extremity of an extensive plain, extending far to the south, south-east, and west, but with the mountains closely approaching the town on the north and north-west, and distant from the sea at Port Royal harbour six miles. At about a quarter of a mile to the north-east of the city runs the Cobre, a river of considerable depth. The town is small, but the buildings are in the magnificent style of Spanish architecture. The government residence, termed the King's House, is a large building occupying one whole side of a quadrangle. On either side are a variety of public edifices appropriated to government purposes; and the buildings fronting it comprehend the court-house, grand and petty jury, and a variety of other apartments above, whilst the lower part is occupied by a number of public offices. There are many splendid edifices in the town and neighbourhood, possessed for the most part by gentlemen of the legal or medical professions, and in some cases by government officers or country proprietors. Spanish Town has a free school, poor-house, a charity for the support of widows, and another for the support of poor maidens and distressed strangers; and the population amounts to about 5000.

Montego Bay is the chief town and sea-port of St James. It is situated at the foot of a range of mountains, which nearly surround it, except on the sea side, and is, in consequence of its trade, a thriving and pretty populous place. It is not, however, equal to what it once was, having twice suffered severely from fire. There is here a neat church, a school, a jail, and other public buildings, including barracks, which are commodious and comfortable. Falmouth, or Marthabrae, which is fifteen miles east of Montego Bay, is the principal town and sea-port of Trelawny. From being an inconsiderable village, this place has become larger and more populous than Montego Bay. It has derived its advantages from its harbour, where a greater quantity of produce is shipped than from any other part of the island, with the exception of Kingston. There is a good church here, a handsome and spacious court-house, a marine hospital, a neat jail, substantial and commodious barracks, with an hospital, stores, and quarters, and a free school. Savannah-le-Mar is a fine military station, in the midst of a highly-cultivated country. The town is situated on the beach, from which a low alluvial flat extends for several miles. In this plain, about one mile from the town, is an excellent range of barracks. In the other towns there is nothing that claims particular attention; each of them having its church, its court-house, its free school, its jail, and its workhouse.

Jamaica is ruled by a governor or captain-general, aided by a council of twelve, and a house of assembly. The

Jamaica. governor is always, and the council generally, appointed by the king, through his secretary for the colonies, from amongst the *ex officio* justices of the peace. The governor, who bears the title of his excellency, is invested with the chief civil and military authority, and has the disposal of such appointments as his majesty does not reserve to himself or his ministers. The council of twelve are appointed by mandamus from the king, and hold their offices during pleasure. The members of this body stand in the same relation to the governor as the privy council in England does to his majesty, giving advice to the superior when necessary. They also constitute a part of the legislature of the colony, and occasionally sit as judges. The lieutenant-governor, chief-justice, attorney-general, and the bishop, are all *ex officio* members of the council. The assembly consists of forty-five members, each of the parishes sending two representatives, and Spanish Town, Kingston, and Port-Royal, one additional member each. The qualification for a representative is a freehold of L.300 per annum, or a personal estate of L.3000. An elector must be of age, and possessed of a freehold of L.10 per annum in the parish for which he votes. The governor and council may, as occasion requires, summon the assembly together; and the former, of his own authority, can adjourn, prorogue, and dissolve them. They have the sole power of levying taxes, and the distribution thereof, with the exception of an annual permanent revenue to the crown of L.10,000. The council and assembly, with the consent of the king or the governor, may make laws, statutes, and ordinances for the public peace, welfare, and good government of the colony, provided these be not repugnant, but, as near as may be, agreeable, to the laws and statutes of Great Britain. The English common law is in force in Jamaica, but many of the statute laws are not; for example, the game-laws, poor-laws, bankrupt-laws, and most of those relating to the revenue. An English statute, to have force in Jamaica, must be re-enacted by the colonial legislature. With regard to the imposition of any duty payable in the colonies, Jamaica is placed in the same situation as the other colonies of Great Britain. By the 18th Geo. III. cap. 12, the king and parliament declared, that thenceforth they would not impose any duty payable in the colonies, except for the regulation of commerce, the produce whereof should always be applied to the use of the colony in which it is levied. The English bankruptcy laws are not in force here; but there is in force the insolvent debtor's act, by which a debtor, on making oath that he is possessed of no property above bare necessaries, and delivering his books, if he has any, into the hands of the deputy-marshal or sheriff's deputy, is, after remaining three months in jail, exonerated from all demands against him. Any person proposing to leave the island must give three weeks' notice of his intention, on account of creditors.

The supreme court of judicature holds its sittings in Spanish Town, three times a year, for three weeks each time. The chief justice, a nominee of government, presides in it, and with him are associated several assistant-judges, who hold their offices during pleasure. The jurisdiction of the supreme court is co-extensive with those of the courts of king's bench, common pleas, exchequer, and insolvent debtors in England, taken collectively. It also decides on questions relative to trade and navigation, the laying on of duties or customs on the import and export of goods, on informations for land under the quit-rent acts, and all escheats; and is likewise a court of appeal from the inferior courts of common pleas. There are two assize-courts, one for the county of Surrey, and the other for the county of Cornwall. Their sittings are similar to those of the supreme court, but at different periods. For each of these there are eight assistant judges appointed, two or three of whom sit in turns with the chief justice. They receive no salaries, and, like the judges of the supreme court, they hold office only during his majesty's pleasure. The several inferior courts of common pleas have jurisdiction over all causes (except those in which a freehold is concerned) to the value of L.20 with costs; but, by the aid of a *justicias* from the chancellor, who is the governor, they may hold pleas to any amount, except in actions where the title to land or negroes is concerned. These courts are held at the same time, and in the same place of the respective precincts, as the justices of the peace hold the quarter-sessions, once in every three months; but some of them have the privilege of sitting oftener.

The parishes are under the government of a chief magistrate, termed the *custos rotulorum*, and bench of justices, who hold sessions of the peace every month, and courts of common pleas, for trying actions to the extent of L.20; debts not exceeding 40s. being determined by a single justice. Each parish has a rector and church officers, according to the number of churches or chapels therein; the vestries consist of the *custos*, two magistrates, ten vestrymen, and the rector; the vestries have the power of assessing and appropriating local taxes, alloting labourers for repairing the highways, appointing way-wardens, nominating collectors of public and parochial rates, and regulating the police of their several parishes.

In the court of chancery the governor sits as chancellor, with powers similar to those of the lord high chancellor in England, and the proceedings are the same as those of the English court of chancery. There is also a court of error, where appeals lie from the courts of law, and of which the governor and council are the judges; a court of ordinary, for determining ecclesiastical matters, of which the governor is judge; and a court of vice-admiralty, the judge of which is appointed by the crown.

The commerce of this important island consists of the trade with the mother country, the trade with British North America, and the trade with the island of Cuba and other Spanish islands, the Spanish Main, and other territories on the American continent formerly belonging to Spain. Its extent will be seen by the following return.

	Shipping Inwards.								Shipping Outwards.							
	From Great Britain.		From British Colonies.		From Foreign States.		Total Inwards.		To Great Britain.		To British Colonies.		To Foreign States.		Total Outwards.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
1828	240	75,541	165	22,974	269	25,687	674	124,202	287	87,729	145	18,205	256	24,454	688	130,388

In 1830 the total shipping inwards was, number, 715; tons, 120,721: outwards, 690; tons, 130,747: employing altogether about 15,000 seamen. The extent of the commerce of this island will be perceived from the following table:

A General Return of Imports and Exports to and from the Island of Jamaica, between the 29th September 1828 *and* 29*th September* 1829.

IMPORTS.

	Flour.	Corn Meal.	Bread.	Rice.	Corn, Beans, Oats, &c.	Dry Fish.	Pickled Fish.			Staves and Heading.	Shingles.	Lumber.	Wood Hoops.	Live Stock.			
														Horses.	Mules.	Asses.	Cattle.
	Barrels.	Barrels.	Cwts.	Pounds.	Bushels.	Quintals.	Tier.	Bar.	Kits.		Number.	Feet.					
From Great Britain and Ireland.....	3,429	128	147	226,971	4,845	...		46,474		52,003	...	312,918	25,432	4	44	22	1
Foreign Ports in Europe...............	1,346	...	...	...	593	...	...	...	...	10,260	...	...	...	34	...	...	...
British Plantations......................	7,129	3,791	369	47,351	1,676	1,455,329	136	26,677	2,572	3,004,342	3,841,890	4,286,769	94,000	48	...	...	...
Foreign Ports within the Tropics....	25,787	6,345	757	471,677	15,482	...	...	...	...	2,951,311	2,782,079	1,232,861	...	1,240	1,475	325	1,089
Total Imports..............	37,691	10,264	1,273	745,999	22,596	1,455,329	136	73,151	2,572	6,017,916	6,623,969	5,832,548	119,432	1,326	1,519	347	1,090

EXPORTS.

	Sugar.			Rum.			Molasses.	Ginger.		Coffee.	Pimento.	Arrow Root.		Lime Juice.	Sweet-meats.	Cotton.	Hides.	Logwood.	Fustic.	Nicaragua Wood.	Lignum Vitæ.	Ebony.	Mahogany and Cedar.	Cabinet Wood.	Lance Wood Spars.
	Hds.	Tier.	Bar.	Pun.	Hds.	Csk.	Pun.	Bar.	Bags.	Pounds.	Pounds.	Bar.	Kegs.	Pun.	Pac.	Bal.	No.	Tons.	Tons.	Tons.	Tons.	Tons.	Logs.	Pieces.	Number.
To Great Britain and Ireland..........	90,289	8,886	2,178	30,267	2,326	102	107	1,304	318	18,581,045	4,974,755	152	4,060	80	675	279	9,882	7,261	1,452	328	318	244	2,219	1,750	29,200
Foreign Ports in Europe...	...	...	...	554	11	...	...	...	...	...	25,363	...		...	...	...	...	115	135	...	...	...	...	...	124
British Plantations.......	861	709	1,204	4,608	166	206	53	29	9	123,304	130,829		38	94	20	14	519	27	1	...	18	...	258	...	...
Foreign Ports within the Tropics.......	...	...	...	1,502	17	327	7	...	...	251,403	938,180	32		42	20	...	...	...	...	...	...	...	...	...	...
Total Exports...	91,150	9,565,	3,382	36,931	2,520	646	167	1,333	319	18,955,752	6,069,127	184	4,098	216	715	293	10,401	7,403	1,588	328	336	244	2,477	1,950	29,324

Jamaica.

It is always a difficult matter to form a definite idea of the amount of property in any place; but that in Jamaica, moveable and immoveable, is not over-estimated at L.50,000,000 sterling money.

The annual income, or ways and means, of the island, on an average of ten years, has been estimated at about L.490,000. The returns, however, are far from being explicit, for it is nearly impossible to ascertain the actual state of taxes in the island, and the nature of their bearing and operation on commerce. The expenditure for 1831, according to a return laid before parliament, amounted to L.370,000, the items being as follows:—

Governor	L.5,500
Chief justice	4,000
Assistant judges	3,400
Speaker of assembly	1,400
Governor's secretary	3,000
Officers of his majesty's customs	23,390
Clergy of established church	23,593
Ditto Presbyterian	1,201
Ditto Roman Catholic	200
Charitable institutions	14,656
Army expenses	157,032
Clerk of supreme court and provost marshal	1,160
Secretary of commissioners of public accounts	1,000
Secretary of ditto correspondents	300
Clerk of board of works	400
Commissioners of stamps	1,550
Deputy receiver-general and secretary at the outports	1,560
Marshals of militia regiments	1,050
Alien and bonding office	600
Island agent	2,542
Captains of forts	669
Officers of assembly	6,146
Island botanist	560
Engineer and surveyor of public works	740
Storekeeper	500
Receiver general	7,000
Law expenses and jails	14,874
Roads, bridges, and public buildings	25,850
Printing	7,159
Militia arms, and gunpowder	8,594
Board of works	8,890
Premium on increase slaves	8,120
Registry and vestry returns	5,378
Maroons, and superintendent of maroon towns	2,030
Miscellaneous	10,000
Interest on public loans	16,900
	L.370,000

According to the Jamaica budget for 1832, the income of the island was as follows:—Taxes and internal duties, L.207,367; duties on vessels and cargoes, L.95,970; certificates in circulation, L.399,205; and loan certificates, including L.64,415 loan deposits, L.250,035. Of the expenditure, the military amounts to L.184,143, besides L.222,729 for the general defence of the island, of which L.176,691 was incurred for martial law in 1832. The civil expenditure was L.85,078, of which L.15,544 was for interest. "On a general view," says Montgomery Martin, "it may be stated that the annual public revenue of Jamaica is L.300,000; and the vestry or parish, or local taxation of the different counties, a nearly similar sum." Jamaica thus contributes a very considerable sum to the national exchequer.

The want of an established currency in the West India islands has long been felt as an evil. In no two islands is the currency alike; and in these again it varies in proportion to sterling money, thus:

	Sterling.		Currency.	Dollar.		Currency.
Jamaica	L.100	=	L.140	1	=	6s. 8d.
Barbadoes	100	=	135	1	=	6s. 3d.
Windward isles, except Barbadoes	100	=	175	1	=	8s. 3d.
Leeward isles	100	=	200	1	=	9s.

The metallic currency of the island is estimated at L.100,000. The paper currency consists entirely of the island checks issued by the receiver-general, under the orders of the board of accounts, and upon the security of the island and its revenue. The coins in circulation in this island are chiefly Spanish. There are also some Portuguese gold pieces, and guineas and sovereigns. The Spanish gold coins are doubloons, value sixteen dollars; half doubloons, pistoles, value four dollars; and half pistoles.

In time of war the naval establishment of Jamaica is considerable, but the peace establishment consists only of a few vessels. The military establishment of the island generally includes the head-quarters of four European regiments of the line, one West India regiment composed of Caffres or West Coast African negroes, and a strong detachment of artillery, making altogether an army of about 3000 men; and of colonial militia from 16,000 to 18,000 men at arms, infantry and cavalry, distributed throughout the several counties. All white males from the age of fifteen to sixty are obliged by law to provide themselves with suitable clothing, and to enlist in either the cavalry or militia. Substitutes are not allowed.

The general post-office and packets next claim our attention. This department comprises a deputy postmaster-general, a principal, and numerous other clerks, in Kingston, and deputy-postmasters stationed at proper and convenient distances along the post-roads in every direction. Mails for all parts of the island are despatched every Saturday evening, and an extra one for Spanish Town every Friday morning. Two packets are despatched monthly from Great Britain for this island. The first touches at the Windward Islands, and arrives at Jamaica about the 20th of every month. The second takes a more direct route, and arrives at her destination about a week after the former.

The press, education, and religion, being intimately blended with one another, may be connected together. The press is unshackled by stamp-duties, and on the increase. There are two daily and four weekly newspapers in the island, all conducted with considerable talent, and with little display of party feeling or faction. Education is rapidly spreading under the aid of the local government, as well as by private means. In the budget of the island there is nearly L.10,000 allotted for free schools. The Jamaica free school at Walton Penn, in the parish of St Ann, has L.1620; Woolmer's free school, in the parish of Kingston, has L.1500; Vere free school, L.1120; the Titchfield free school about a similar sum, and so on. There may be about thirty public or free schools, attended by nearly 4000 scholars. Besides these, there are a number of most respectable schools, where classical as well as ordinary education may be obtained. Great efforts have been made for the extension of religion, but whether with a success commensurate to the exertions bestowed it is difficult to say. The outlay by the colonial government for 1831 was nearly L.25,000, of which the curates' stipends amounted to L.8000; rectors' ditto, to L.11,718; expenses of building of chapels, L.1400; annuities of widows and orphans of the clergy, L.2000; salaries of the registrar and appositar of the diocese, L.475; Presbyterian institutions, Jamblicus. L.301; support of kirk in Kingston, L.700; Presbyterian charity schools, L.200. The bishop of Jamaica, whose see extends over the Bahamas and Honduras, has L.4000, and the archdeacon L.2000, per annum. There are fifty-seven clergymen of the established church, twenty-one of whom are rectors; four of the Scotch Presbyterian church, twenty-four of the Wesleyan Methodist persuasion, sixteen of the Baptist, and eight of the Moravian. The crown livings are now in the gift of the bishop. The established clergy are paid partly by stipend and partly by fees. With regard to the expenditure of Jamaica for her ecclesiastical establishments, the Rev. Mr Bridges informs us, that of late years it has not fallen far short of L.30,000 annually. Pluralities are not permitted; and the negro apprentices, as they are now called, are entitled to demand the gratuitous services of the clergy.

Owing to some mistaken feelings, the census of Jamaica has not been taken, so that it is impossible to state with accuracy the actual population of the island. By some it is said to be half a million, which would give seventy-eight persons to the square mile. The following is a summary for 1833, of the returns of the number of slaves, now apprentices, in the island, the number of stock or horned cattle, and the quantity of land in cultivation and pasture. The returns are given in upon oath.

	Slaves.	Stock.	Acres of Land.
Middlesex	121,194	65,416	1,026,486
Surrey	74,286	16,455	390,386
Cornwall	107,152	83,373	818,852
	302,632	165,244	2,235,724

By some the number of whites is estimated at 35,000; and of maroons there are about 1200 in Jamaica. The number of what are denominated free people of colour has not been ascertained, but the total population of the island is not over-estimated at between 400,000 and 500,000.

Before concluding the account of Jamaica, it is necessary to refer to a dependency called the Cayman Isles. These are three small isles, in latitude 19. 20. north, and from thirty to forty leagues north-north-west from Point Negrill, to the westward of Jamaica, the Grand Cayman being the most remote. Cayman-braque, and Little Cayman, lie within five miles of each other, and about thirty-four miles north from the Grand Cayman. These islands were discovered by Columbus, but they were never permanently settled until after the conquest of Jamaica by Great Britain. Grand Cayman, the only one of them occupied, is about one mile and a half long, one mile broad, and contains about 1000 acres. It is very low, but towards the middle of the island vegetation is abundant. These islands are favourite breeding places for turtles, immense shoals of which animals cross the ocean from the Bay of Honduras, to deposit their eggs on the low, sandy shore of the Caymans. The present race of inhabitants, of whose numbers accurate accounts have not been given, are said to be descended from the English Buccaneers, and, from being inured to the sea, form excellent pilots and seamen. The bishop of Jamaica estimated their numbers in 1827 at 1600. They are very healthy, and attain to a great age. Justices of the peace are sent from Jamaica, but in no way are the inhabitants interfered with by the chief settlement to which they belong. They have a chief or government officer of their own choosing, and they frame their own regulations.

With regard to the working of the emancipation bill, by which, from the 1st of August 1834, the slaves aged six and upwards became apprenticed labourers, without any formal indentures, nothing as yet can be said with certainty. Any disturbances which have broken out were anticipated, even by those who were most sanguine as to the success of the measure; but when the negroes shall have become familiar with their change of condition, their transition from a state of slavery to that of freedom, every thing will probably go on prosperously. At all events, from the accounts received, we are entitled to indulge in a less gloomy augury for the future, than has been but too generally entertained by those who investigated the subject, or were interested in the change. (R. R. R.)

JAMBLICUS, the name of two celebrated Platonic philosophers, one of whom was a native of Chalcis, and the other of Apamea in Syria. The first, whom Julian compares to Plato, was the disciple of Anatolius and Porphyry, and died under the reign of the Emperor Constantine. The second also enjoyed great reputation. Julian wrote several letters to him; and it is said he was poisoned under the reign of Valens. It is not known to which of the two we ought to attribute the works which have reached us in Greek under the name of Jamblicus. These are, 1. Protrepticus, seu adhortatio ad philosophiam, Leipsig, 1813, in 8vo; 2. De Vita Pythagoræ, Amsterdam, 1707, in 4to, Greek and Latin, with the corrections and notes of Ludolf Kuster; 3. In Nicomachi Geraseni Arithmeticam Introductionem et De Fato liber, nunc primum editus Græce, in Latinum Sermonem conversus, notis illustratus a Sam. Tennulio, Arnheim, 1688, in 4to; 4. De Mysteriis Ægyptiorum, Venet. Aldus, 1497, in folio, a work filled with theurgic and extravagant notions. Hebenstreit has published a learned dissertation *De Jamblichi philosophi Syri doctrina, Christinæ religioni quam imitari studet, noxia*, Leipsig, 1764, in 4to. The system of the Neo-Platonists was built on the doctrine of *emanation*, according to which all beings are destined, after undergoing several degrees of purification, to return to the Deity, whence they emanated. By this system, the sage may, even in this life, attain to the *intuition* of the divinity, the most sublime end or aim of philosophy. This school admitted the existence of a class of demons, or spirits of an inferior order, mediators between God and man. To enter into communication with them required great purity of manners, and a holiness which disengaged man from every thing terrestrial. Fallen souls inhabit bodies which serve as their prison; and if, during their lives, they have not laboured to divest themselves of their vices, they are, after death, sent back to other bodies still more vile, until they be entirely purified; a doctrine which approximates closely to metempsychosis. The Neo-Platonists also admitted a species of trinity; the soul, according to them, emanated from the intelligence, or second divine essence (νους), which again emanates from the infinite and perfect being. In order to oppose the progress of Christianity, which began to ruin all established religions, it was believed necessary to envelope in obscurity this doctrine of emanations; and hence they affected to regard as the authors of this system Zoroaster in Persia, Orpheus in Thrace, and Hermes in Egypt. (Schoell, *Hist. Abrég. de la Littér. Grecque*, tom. i. p. 203.)

James, St. JAMES, St, called the *Greater*, the son of Zebedee, and the brother of John the Evangelist, was born at Bethsaida in Galilee. He was called to be an apostle, together with St John, as they were mending their nets with their father Zebedee, who was a fisherman; when Christ gave each of them the name of Boanerges, or Son of Thunder. They then followed Christ, were witnesses, with St Peter, of the transfiguration on Mount Tabor, and accompanied our Lord in the garden of olives. It is believed that St

James first preached the gospel to the dispersed Jews; and afterwards returned to Judæa, where he preached at Jerusalem, when the Jews raised up against him Herod Agrippa, who put him to a cruel death, about the year 44. Thus St James was the first of the apostles who suffered martyrdom. St Clement of Alexandria relates, that his accuser was so struck with his constancy, that he became converted, and suffered with him.

James, *St*, called the *Less*, an apostle, the brother of Jude, and the son of Cleophas, and Mary the sister of the mother of our Lord, is called in Scripture the *Just*, and the brother of Jesus, who appeared to him in particular after his resurrection. He was the first bishop of Jerusalem, when Annanias II. high priest of the Jews, caused him to be condemned and delivered into the hands of the people and the Pharisees, who threw him down from the steps of the temple, when a fuller dashed out his brains with a club, about the year 62. His life was so holy, that Josephus considers the ruin of Jerusalem as a punishment inflicted on that city for his death. He was the author of the epistle which bears his name.

St James of the Sword (*San Jago del Espada*), a military order in Spain, instituted in 1170, under the reign of Ferdinand II. king of Leon and Gallicia. Its object was to put a stop to the incursions of the Moors, these knights obliging themselves by a vow to secure the roads. An union was proposed and agreed to in 1170, between these and the canons of St Eloy; and the order was confirmed by the pope in 1175. The highest dignity in that order is that of grand-master, which has been united to the crown of Spain. The knights were obliged to give proof of their descent from families that had been noble for four generations on both sides; they also were required to make it appear that their ancestors were neither Jews, Saracens, nor heretics, nor had ever been called in question by the inquisition.

James, the name of several kings of Scotland and of Great Britain.

James I. king of Scotland in 1423, the first of the house of Stuart, was not only the most learned king, but one of the most learned men, of the age in which he flourished. This ingenious and amiable prince fell into the hands of the enemies of his country in his tender youth, when he was flying from the snares of his unnatural and ambitious uncle, who governed his dominions, and was suspected of designs against his life. Having secretly embarked for France, the ship was taken by an English privateer off Flamborough Head; and the prince and his attendants were confined in a neighbouring castle until they were sent to London. The prince was conducted to the Tower immediately after he was seized, on the 14th of April 1405 (in the thirteenth year of his age), and there kept a close prisoner till the 10th of June 1407, when he was removed to the castle of Nottingham, from which he was brought back to the Tower on the 1st of March 1414, and there confined till the 3d of August in the same year, when he was conveyed to the castle of Windsor, where he was detained till the summer of 1417, when Henry V., for political reasons, carried him with him into France in his second expedition. In this melancholy situation, so unsuitable to his age and rank, books were his chief companions, and study his greatest pleasure. That he wrote as well as read much we have his own testimony, and that of all our historians who lived near his time. Bowmaker, the continuator of Fordun, who was his contemporary, and personally acquainted with him, spends ten chapters in his praise, and in lamentations for his death; and, amongst other things, states that his knowledge of the Scriptures, of law, and philosophy, was incredible. Hector Boyce tells us that Henry IV. and Henry V. furnished their royal prisoner with the best teachers in all the arts and sciences; that, by their assistance, he made great proficiency in every part of learning and the fine arts; and that he became a perfect master in grammar, rhetoric, poetry, music, and all the secrets of natural philosophy, and was inferior to none in divinity and law. This prince's skill in music was remarkable. Walter Bower, abbot of Inchcolm, who was intimately acquainted with him, assures us that he played on eight different instruments, which he names, and especially on the harp, with such exquisite skill, that he seemed to be inspired.[1] Above a century after his death he was celebrated in Italy as the inventor of a new and pleasing kind of melody, which had been admired and imitated in that country. This appears from the following testimony of Tassoni, a writer who was well informed, and of undoubted credit. "We may reckon amongst us moderns, James king of Scotland, who not only composed many sacred pieces of vocal music, but also of himself invented a new kind of music, plaintive and melancholy, different from all other; in which he had been imitated by Carlo Gesualdo, prince of Venosa, who, in our age, has improved music with new and admirable inventions."[2] After spending almost twenty years in captivity, and encountering many difficulties on his return into his native kingdom, he was murdered by barbarous assassins in the prime of life. Many of the productions of his pen have perished, for only three poems that have been ascribed to him are now extant, viz. Christ's Kirk on the Green; Peebles at the Play; and the King's Quair. But slender as these remains are, they afford sufficient evidence that the genius of this royal poet was not inferior to that of any of his contemporaries, and that it was equally fitted for the gayest or the gravest strains. (See *Poetical Remains of James I.* Edinburgh, 1783; and Warton's *History of Poetry*, vol. ii. p. 12.)

James V. king of Scotland, was but eighteen months old when his father fell in the battle of Flodden Field in 1513. When of age he assisted Francis I. king of France against the Emperor Charles V.; a service for which, in 1535, Francis gave him his eldest daughter in marriage. This princess died in two years; and James married Mary of Lorraine, daughter of Claude duke of Guise, and widow of Louis d'Orleans, by whom he had only one child, Mary queen of Scots, born only eight days before his death, which happened on the 13th of December 1542, in the thirty-fifth year of his age. This was the first prince of his family who died a natural death since its elevation to the throne. He is said to have been the author of a humorous composition called the *Gaberlunzie Man*.

James VI. king of Scotland in 1567, and of England in 1603, was son of Mary queen of Scots, whom he succeeded in Scotland, as he did Elizabeth in England. He valued himself much upon his polemical writings, and was so fond of theological disputations, that, to keep them alive, he founded Chelsea College for the express purpose of attaining this object; but it was converted to a much better use by Charles II. His *Basilicon Doron*, his Commentary on the Revelation, his writings against Bellarmine, and his *Dæmonologia*, or doctrine of witchcraft, are sufficiently known. A collection of his writings and speeches was published in one folio volume. He died in 1625, in the fifty-ninth year of his age and twenty-third of his reign.

James, *Thomas*, a learned English critic and divine, was born at Newport, in the Isle of Wight, about the year 1571. Having completed his preliminary studies at West-

[1] *Scotichronicon*, lib. xvi. c. 18.

[2] Alessandro Tassoni *Pensieri Diversi*, lib. x.

minster School, he entered New College, Oxford, of which he became a fellow in 1593; took his degree as master of arts in 1599; and having collated several manuscripts of the *Philobiblion* of Richard of Durham, which he published in 4to, dedicated to Sir Thomas Bodley, he recommended himself to the favour of that munificent patron of learning, and through his influence was in 1602 appointed keeper of the public library, an office which he held during eighteen years. In 1614 he was created doctor in divinity, promoted to the archdeaconry of Wells, and about the same time presented to the rectory of Mongeham in Kent, not to mention other spiritual preferments. In 1620 he resigned his situation as librarian, and applied himself chiefly to the readings of old manuscripts, in which he assures Archbishop Usher that he had restored three hundred citations, or rescued them from corruptions. Having been chosen a member of the convocation held with the parliament at Oxford in 1625, he there moved to have commissioners appointed to collate the manuscripts of the fathers in all the libraries of England, with the Roman Catholic editions; but as this project did not meet with the desired encouragement, he himself undertook the arduous task, and continued to prosecute it until his death, which took place in August 1629. He left behind him a great number of learned works, the principal of which are, 1. Philobiblion Ricardi Dunelmensis, 1599; 2. Cyprianus Redivivus, London, 1600; 3. Catalogus Librorum in Bibliotheca Bodleiana, Oxford, 1605, in 4to; 4. Concordantiæ SS. Patrum, Oxford, 1607, in 4to; 5. Apology for John Wickliffe, Oxford, 1608, in 4to; 6. Specimen Corruptelarum Pontificiorum in Cypriano, Ambrosio, Gregorio Magno, &c. London, 1626; 7. Index librorum prohibitorum a pontificibus, Oxford, 1627, in 8vo; and, 8, some pieces in manuscript. (A.)

James, *Dr Robert*, an English physician, particularly distinguished by the preparation of a fever powder, was born at Kinverston, in Staffordshire, in 1703; his father was a major in the army, his mother a sister of Sir Robert Clarke. He was of St John's College in Oxford, where he took the degree of bachelor of arts; and afterwards practised physic at Sheffield, Lichfield, and Birmingham successively. He then removed to London, and became a licentiate in the college of physicians; but in what year is not known. At London he applied himself to writing, as well as practising physic; and in 1743 published a Medical Dictionary, in three vols. folio. Soon afterwards he published an English translation, with a supplement by himself, of *Ramazzini de morbis artificum;* to which he also prefixed a piece of Frederic Hoffman upon Endemical Distempers, 8vo. He also published, in 1746, The Practice of Physic, 2 vols. 8vo; in 1760, On Canine Madness, 8vo; in 1764, A Dispensatory, 8vo. In June 1755, when the king was at Cambridge, James was admitted by mandamus to the doctorship of physic. In 1788 were published, A Dissertation upon Fevers, and A Vindication of the Fever Powder, 8vo; with A Short Treatise on the Disorders of Children. This was the eighth edition of the Dissertation, the first of which had been printed in 1751; and the purpose of it was to set forth the success of this powder, as well as to describe more particularly the manner of administering it. The Vindication was posthumous and unfinished; for he died in March 1776, whilst he was employed upon it.

James, *St*, a town of the arrondissement of Avranches, in the department of the Channel, or, as it is sometimes called, of La Manche, in France. It is situated on the river Beuvron, and has a castle, 406 houses, and 2696 inhabitants.

JAMESON, George, an eminent artist, the Vandyck of Scotland, was the son of Andrew Jameson, an architect, and born at Aberdeen in 1586. He studied under Rubens at Antwerp; and, after his return, applied with indefatigable industry to portraits in oil, though he sometimes practised in miniature, and also in history and landscape. His largest portraits were generally somewhat less than life. His earliest works are chiefly on boards, but he afterwards painted on a fine linen cloth, smoothly primed with a proper tone, to help the harmony of his shadows. His excellence is said to consist in delicacy and softness, with a clear and beautiful colouring; his shades are not charged, but helped by varnish, with little appearance of the pencil. When King Charles I. visited Scotland in 1633, the magistrates of Edinburgh, knowing his majesty's taste, employed Jameson to make drawings of the Scottish monarchs, with which the king was so pleased, that he sat to him for a full-length picture, and rewarded him with a diamond ring from his own finger. Jameson always drew himself with his hat on, either in imitation of his master Rubens, or from having been indulged in that liberty by the king when his majesty sat to him. Some of Jameson's works are in the colleges of Aberdeen; and the Sibyls there he is said to have drawn from living beauties in that city. But the greatest collection is that at Taymouth, the seat of the Marquis of Breadalbane; Sir John Campbell of Glenorchy, ancestor of the noble marquis, having been the chief patron of Jameson, who, in fact, attended him in his travels. This artist died at Edinburgh, and was interred in the Greyfriars church-yard, but without a monument. Jameson was but little known in England, and has not been noticed by any English writer on the fine arts, except Lord Orford. But he was much esteemed in his own country; and Arthur Johnston, the poet, addressed to him an elegant Latin epigram on his portrait of the Marchioness of Huntley.

JAMPOL, a town of the province of Podolia, in Russia, the capital of a circle of the same name, and situated on the river Dnieper. It is the frontier town towards the Turkish dominions, and has a quarantine and custom-house. Long. 28. 24. E. Lat. 48. 15. N.

JAMTLAND, a province in the north of Sweden, extending over 17,732 square miles, and bounded on the west by Norway, and on the other sides by Swedish provinces. It is mountainous, as there are five chains of alpine elevations that cross it from west to east, several of whose points are 7000 feet in height. Through some of these ranges routes have been opened, which are still passed with difficulty, from their steepness and ruggedness. Between the ranges are some valleys, which would be fruitful but for the severity of the climate, which is an impediment to the growth of any corn besides oats, with which the inhabitants often mix the bark of the pine-trees to make their bread. The chief nourishment of the inhabitants is supplied by the dairy and the fisheries, but chiefly by the latter. The province yields abundance of timber, and some supplies of copper, lead, iron, and alum. It has but two towns, both small; Ostersund is the capital, with only 200 inhabitants. The whole population is about 32,000 persons. It is between latitude 61. 39. and 65. 6. north.

JAMYN, Amadis, a French poet of the sixteenth century, was born at Chaource, in Champagne, about the year 1540. His parents, who were respectable, neglected no means calculated to promote his education. He received instructions from Dorat, Turnebus, and other learned men, who early inspired him with a taste for letters; and he also studied philosophy and the mathematics with some success; but an invincible predilection led him to poetry, in the cultivation of which he appears to have received marked encouragement from Ronsard, who was then regarded as the greatest man in France. From a passage in one of his elegies, it has been conjectured that in his youth he travelled through part of Greece and of Asia Minor; it is more certain that he visited Dauphiné, Provence, and Poitou, since he cites the names of the cities where he had sojourned, and complains of the reception which he had met with at Poitiers. Ronsard procured him the situation of secretary and reader to the king, Charles IX.; but after the death of his benefactor, he quitted the court, and retired to his native city, where he died about the year 1585, at comparatively an early age. The *Œuvres Poétiques* of Jamyn were published at Paris in 1575, and again in 1577, in 4to. This collection is divided into five books, the first of which contains the pieces addressed to Charles IX. and the great lords of the court, and the four following, sonnets, eclogues, elegies, and other amatory pieces. Jamyn completed, in Alexandrine verses, the translation of the Iliad of Homer, which Hugues de Salel had commenced in decasyllabic measure, and which stopped at the twelfth book; and he had also the merit of perceiving that Homer could only be translated into stately and majestic verses. After having given a first edition of the thirteen last books of the Iliad (Paris, 1574, in 4to), he revised and corrected the work of Salel, which he published along with his own (Paris, 1580 and 1584); and this addition is augmented by a translation of the first three books of the Odyssey. In these translations by Jamyn, there are beautiful verses, and passages rendered in a manner truly poetical; but he has thrown ridicule on his own performance by assigning modern titles to the heroes of the Iliad, and thus giving it the air and appearance of a travesty. (A.)

JANEIRO. See Rio Janeiro.

JANICULUM, a hill on the opposite side of the river Tiber from Rome, said to have derived its name from the city built on its summit by Janus. (Virgil, *Æn.* viii. 354.) At the foot Numa was buried, and many centuries afterwards his tomb is said to have been found here. (Liv. xl. 29.) This part of Rome was at first peopled by the inhabitants of certain Latin cities transferred thither by Ancus Martius. (i. 33.)

JANIZARIES, or Janissaries, an irregular infantry, which, until the year 1826, formed the principal strength of the Turkish army. Vossius derives the word from *genizers*, which in the Turkish language signifies *novi homines* or *milites*. But D'Herbelot tells us that *jenitcheri* signifies a *new band* or *troop*, and that the name was first given by Amurath I. called the Conqueror, who, having selected one fifth of the Christian prisoners whom he had taken from the Greeks, and instructed them in the discipline of war and the doctrines of Islamism, sent them to Hagi Bektasche, a person whose pretended piety rendered him extremely revered amongst the Turks, that he might confer his blessing on them, and at the same time give them some mark to distinguish them from the rest of the troops. Bektasche, after blessing them in his manner, cut off one of the sleeves of the fur gown which he had on, and put it on the head of the leader of this new militia; and from that time, namely, the year 1361, they retained the name of *jenitcheri*, and the fur cap.

At the time when the janissaries were thus instituted, there was not a single power in Europe which maintained a regular body of troops in its pay. The Christian armies were raised at the will of the nobility, who brooked no superior, and seized the first pretext to leave the armies of their sovereign, and return with their vassals to their strongholds. The advantage of union against a common enemy was not felt or appreciated; and victory declared in favour of those troops who to courage and enthusiasm united some degree of discipline, and a blind obedience to the will of their leaders. Such were the janissaries originally. They swept all before them; and, whilst the capture of Christians furnished slaves to supply the vacancies in their ranks, fortune smiled on their prowess and daring. But when this body ceased to form a class separate from the nation; when they were allowed to marry and enrol their children, and the *odas* (companies or regiments) were encumbered with men who preferred an inglorious life in the retirement of their families to the fatigues and dangers of the field; then the janissaries ceased to be formidable to their enemies, and, like the prætorian guards of Rome, were only dreaded by the sultans. Yet on this class did the Porte, until recently, depend for defence against its enemies; and although their inefficiency became daily more apparent, no reform could be effected in the system. In vain did Selim attempt to remodel them; his life paid the forfeit of his temerity. In vain did Mahmoud, upon his accession to the throne, wish to enforce the regulations of Suleiman the Magnificent. The consequence was an insurrection, which, during three days, inundated his capital with blood, and obliged him, in self-defence, to command the execution of his own brother. But the stern disposition of Mahmoud was in no degree daunted by this failure. He now saw that nothing less than the entire destruction of the janissaries would enable him to improve the condition of his empire; and he waited patiently until he could strike a blow with the certainty of success. In 1826, the janissaries again mutinied; but this time they found the sultan prepared, and they gave but the signal for their own destruction. The artillery-men and other troops faithful to the sultan surrounded them in the Etmeidan. They attempted to defend themselves, but without success, and about twenty thousand perished in the hopeless conflict. The suppression of this body, which immediately followed, left Mahmoud at liberty to remodel his army in such a manner as appeared best suited to the times; and, accordingly, he lost no time in taking measures to supply the void occasioned by the destruction of the only military force in the empire. See Turkey.

JANSEN, Cornelius, bishop of Ypres, one of the most learned divines of the seventeenth century, and principal of the sect called from his name *Jansenists*. He was born in Holland, of Catholic parents, and studied at Louvain. Being sent into Spain to transact some business of consequence relating to the university, the Catholic king, viewing with a jealous eye the intriguing policy of France, engaged him to write a book to expose the French as doubtful Catholics, since they made no scruple of forming alliances with Protestant states. Jansen performed this task in his *Mars Gallicus*, and was rewarded with a mitre, being promoted to the see of Ypres in 1635. Before this he had maintained a controversy against the Protestants, upon the points of grace and predestination; but his *Augustinus* was the principal labour of his life, upon which, it is said, he spent above twenty years.

JANSENISTS, a sect of Roman Catholics in France, who followed the opinions of Jansen or Jansenius in relation to grace and predestination.

In the year 1640, the universities of Louvain and Douay, and particularly Father Molina and Father Leonard Celsus, thought fit to condemn the opinions of the Jesuits on grace and free will. This having set the controversy on foot, Jansenius opposed to the doctrines of the Jesuits the sentiments of St Augustin, and wrote a treatise on grace, which he entitled *Augustinus*. This treatise was attacked by the Jesuits, who accused Jansenius of maintaining dangerous and heretical opinions, and afterwards, in 1642, obtained of Pope Urban VIII. a formal condemnation of the treatise; but the partisans of Jansenius gave out that this bull was spurious, or, in other words, composed by a person entirely devoted to the Jesuits. After the death of Urban VIII. the affair of Jansenism began to be more warmly controverted, and gave birth to an infinite number of polemical writings concerning grace. And what occasioned no little mirth was the titles which each party gave to their writings; one writer published *The Torch of St Augustin*, another found *Snuffers for St Augustin's Torch*, and Father Vernon formed *A Gag for the Jansenists*. In the year 1650, sixty-eight bishops of France subscribed a letter to Pope Innocent X. to obtain an inquiry into, and condemnation of, the following propositions, extracted from Jansenius's *Augustinus:* 1. Some of God's commandments are impossible to be observed by the righteous, even though they endeavour with all their power to accomplish them. 2. In the state of corrupted nature, we are incapable of resisting inward grace. 3. Merit and demerit, in a state of corrupted nature, do not depend on a liberty which excludes necessity, but on a liberty which excludes constraint. 4. The Semi-Pelagians admitted the necessity of an inward preventing grace for the performance of each particular act, even for the beginning of faith; but they were heretics in maintaining that this grace was of such a nature that the will of man was able either to resist or obey it. 5. It is Semi-Pelagianism to say that Jesus Christ died or shed his blood for all mankind in general.

In the year 1652, the Pope appointed a congregation for examining into the dispute in relation to grace. In this congregation Jansenius was condemned; and the bull of condemnation, published in May 1653, filled all the pulpits in Paris with violent outcries and alarms against the heresy of the Jansenists. In the year 1656, Pope Alexander VII. issued another bull, in which he condemned the five propositions of Jansenius. However, the Jansenists affirm that these propositions are not to be found in his book; but that some of his enemies, having caused them to be printed on a sheet, inserted them in the book, and thereby deceived the pope. At last Clement XI. put an end to the dispute by his constitution of the 17th July 1705, in which, after having recited the constitutions of his predecessors in relation to this affair, he declares, "That in order to pay a proper obedience to the papal constitutions concerning the present question, it is necessary to receive them with a respectful silence." The clergy of Paris, in the same year, approved and accepted of this bull, and none dared to oppose it. This is the famous bull *Unigenitus*, so denominated from its beginning with the words *Unigenitus Dei Filius*.

JANSSEN, Cornelius, called *Johnson*, an eminent painter of portraits, was born at Amsterdam, though, in the Chronological Tables, and in Sandrart, it is asserted that he was born in London; but he resided for several years in England, where he was engaged in the service of King James I. and painted several excellent portraits of that monarch, as also of his children, and of the principal nobility of his court. He had not the freedom of hand, nor the grace, of Vandyck; but in other respects he was accounted his equal, and in the finishing of his pictures superior. His paintings are easily distinguished by their smooth, clear, and delicate tints, and by that character of truth and nature with which they are strongly marked. He generally painted on boards; and his draperies are for the most part black, probably because the opposition of that tint made his flesh colours appear more beautifully bright, especially in his female figures. He frequently painted in a small size in oil, and often copied his own works in that manner. His fame began to be somewhat obscured on the arrival of Vandyck in England; and the civil war breaking out some time afterwards, induced him to return to his own country, where his paintings were held in the highest esteem. He died in 1685.

Janssens, *Abraham*, an historical painter, was born at Antwerp in 1569. He was contemporary with Rubens, and also his competitor, and in many of the finest parts of the art was accounted not inferior to that celebrated master. It is reported, that having wasted his substance by a life of dissipation and pleasure, and falling in consequence into necessitous circumstances, which, however, he imputed to ill fortune rather than to his own neglect of his business, he grew envious of the grandeur in which Rubens appeared, and, impatient of his merit and success, challenged him to paint a picture with him for fame alone. But Rubens rejected the proposal, answering with modesty, that he freely submitted to him, and the world would certainly do justice to them both. Sandrart, who had seen several of his works, assures us, that he not only gave a fine roundness and relief to his figures, but also such a warmth and clearness to the carnations, that they had all the appearance of real flesh; and his colouring was as durable as it was beautiful, retaining its original lustre for a number of years. His capital performance is said to have been the resurrection of Lazarus, which was in the cabinet of the elector-palatine, and an object of admiration to all who beheld it.

Janssens, *Victor Honorius*, an historical painter, was born at Brussels in 1664. He was a disciple of Volders, under whose direction he continued for seven years, during which time he gave many proofs of a superior genius. He afterwards went to Rome, where he studied particularly the works of Raffaelle. He designed after the antiques, and sketched the beautiful scenes around that city. In a short time his paintings rose in esteem, and the principal nobility of Rome were desirous to employ him. He associated for several years with Tempesta, the celebrated landscape painter, and painted the figures in the works of that great master as long as they resided together. Janssens composed historical subjects, both in a small and a large size; but he found the demand for his small pictures so considerable, that he was induced to paint most frequently in that size. He continued at Rome during eleven years, which barely sufficed for his finishing those pictures which he was engaged to paint; nor would he have even then been at liberty, had he not limited himself to a number, and determined not to undertake more. On his return to Brussels, his performances were as much admired there as they had before been in Italy; but having married, and become the father of eleven children, he was compelled to change his manner of painting in small, and to undertake only those of the large kind, as being more lucrative, more expeditious, and also more agreeable to his genius and inclination. He adorned with his compositions most of the churches and palaces of his own country.

JANUARIUS, St, the patron saint of Naples, where his head is occasionally carried in procession, in order to stay the eruption of Vesuvius. The liquefaction of his blood is a famous miracle, or rather juggle, at Naples. The saint suffered martyrdom about the end of the third century. When he was beheaded, a pious lady of Naples caught about an ounce of his blood, which has ever since been carefully preserved in a bottle, without having lost a single grain of its weight. This of itself, were it equally demonstrable, might be considered as a greater miracle than the circumstance on which the Neapolitans lay the whole stress, namely, that the blood, which has congealed, and acquired a solid form by age, is no sooner brought near the head of the saint, than, as a mark of veneration, it immediately liquefies.

JANUARY, the name of the first month of the year, according to the computation now used in the West. The word is derived from the Latin *Januarius*, a name given to it by the Romans from Janus, one of their divinities, to whom they attributed two faces, because on the one side the first day of January looked towards the new year, Janus || Japan.

and on the other towards the old one. The word *Januarius* may also be derived from *janua*, a gate; because this month being the first, is, as it were, the gate of the year. January and February were introduced into the year by Numa Pompilius, the year of Romulus having commenced in the month of March. The kalends of this month were under the protection of Juno, and in a peculiar manner consecrated to Janus by an offering of a cake made of new meal and new salt, with new frankincense and new wine. On the first day of January a beginning was made of every intended work; the consuls elect took possession of their office, and, with the flamens, offered sacrifices and prayers for the prosperity of the empire. On this day all animosities were suspended, and friends gave and received new year's gifts, called *Strenæ*.

JANUS, in the heathen worship, the first king of Italy, who, it is said, received Saturn into his dominions, after he was driven from Arcadia by Jupiter. He tempered the manners of his subjects, and taught them civility; and from him they learned to improve the vine, to sow corn, and to make bread. After his death he was adored as a god. This deity was thought to preside over new undertakings. Hence, in all sacrifices, the first libations of wine and wheat were offered to Janus; all prayers were prefaced with a short address to him; and the first month of the year was dedicated to and named from him. Janus was represented with two faces, either to denote his prudence, or that he views at once the past and approaching years. He had a sceptre in his right hand, and a key in his left, to signify his extensive authority, and his invention of locks. Though this is properly a Roman deity, the Abbé la Pluche represents it as derived from the Egyptians, who made known the rising of the dog-star, which opened their solar year, with an image having a key in its hand, and two faces, the one old and the other young, to typify the old and new year.

Temple of Janus || Japan.

Temple of Janus, in ancient history, a square building at Rome, erected by Romulus, and so large as to contain a statue of Janus five feet high, with brazen gates on each side, which were always kept open in time of war, and shut in time of peace. But the Romans were so much engaged in war, that this temple was shut only twice from the foundation of Rome till the reign of Augustus, and six times afterwards.

JAPAN.

The extensive and powerful empire of Japan consists of several large islands on the eastern coast of Asia, which extend in a direction north-east and east-north-east, from the 30th to the 41st degrees of north latitude, and from the 129th to the 143d of east longitude. The largest of these islands is called Niphon, which name is also sometimes applied to the whole empire. It is about 700 miles in length, though not more than eighty in breadth, and runs lengthwise from east to west in a winding form. It is separated by a narrow channel full of rocks and islands, several of them uninhabited, from Sikokf, next to it in size, and which is ninety miles long and fifty broad. The third island, Kiusiu, of a square figure, and divided into four provinces, lies between the other two, and is 200 miles long by 140 broad. These islands are surrounded with numerous others, generally small, rocky, and barren; some of them, however, large, rich, and fruitful, and governed by petty princes. There are several other islands which are subject to the authority of Japan, though they form no integral part of the empire. Among these is the large island of Jesso, which has been colonized by the Japanese, and is the most northerly island they have beyond their own empire. The coasts are rocky and mountainous, and they are washed by a tempestuous sea, which, by reason of its shallowness, admits none but small vessels, and even these not without imminent danger, the depth of most of its gulfs and harbours being not yet known, and others that have been sounded being too shallow for ships of any bulk. Several dangerous whirlpools also occur amongst the rocks and shallows, by which vessels are frequently drawn in and dashed to pieces. It is remarked by Kæmpfer, in his ample and accurate account of Japan, that nature seems purposely to have designed these islands to be a sort of little world, separate and independent of the rest, by making them difficult of access, and by endowing them plentifully with all that is necessary both for luxury and comfort, and thus enabling them to subsist without any commerce with other nations. The Japanese policy, of rigidly forbidding all intercourse with strangers, which, in other circumstances, might have been difficult, if not impracticable, has been greatly facilitated by these natural advantages of the country.

The country, climate, and produce.

These islands are in general rugged and irregular in their surface, intersected by ranges of lofty mountains, which are frequently steep and broken into precipices. Some of the mountains rise to a great elevation, as the mountain of Fusi, in the southern part of Niphon, which is considered to be the most elevated, and is covered with perpetual snow. In the northern part of the same island are also extensive and lofty mountains. The narrow valleys between these mountains are generally fertile and well cultivated; but the greater part of the country is rocky and barren, and it is only by the indefatigable care and industry of the natives that it has been rendered productive, and that it yields an abundant supply of food. The great staple of agriculture is rice, of which there are several varieties: the best sort is perfectly white like snow, very nutritive, and when boiled is used at meals instead of bread. A certain sort of bean, of which they make a mealy pap, and use in the dressing of victuals as butter is used in Europe, is held in much esteem. Barley, which they call great corn, is cultivated, though not in great quantities: they use it in the feeding of cattle and horses, whilst others dress their victuals with the flour, or make cakes of it. One sort of barley, which grows in Japan with purple-coloured ears, gives a very pleasing aspect to the fields. Wheat, which is called small corn, is extremely cheap, and is baked into a particular sort of cakes, though it is but little used. Peas, beans, and Indian corn, are cultivated; and almost all the varieties of nutritious grains and pulse. Turnips grow plentifully in the country, and to a large size. Horse-radish, carrots, gourds, melons, cucumbers, parsnips, fennel, and some sorts of lettuce, grow wild; and parsley and other vegetables, which are cultivated by the Dutch, thrive well. There are numerous other plants, which grow in the fields, the woods, and forests, and in marshy grounds, of which the leaves, roots, or the flowers and fruits, afford sustenance for the common people, and even luxuries for the great.

The Japanese excel in agriculture. Being cut off from all intercourse with other nations, they rely on their own resources; and this, with the extreme populousness of the country, gives a stimulus to cultivation, as well as to every other branch of industry. Not only are the fields and flat country laid out in the cultivation of rice, being seldom converted into pasture, but likewise the hills and mountains afford corn, rice, peas, pulse, and numerous other edible plants. Every inch of ground is improved to the utmost; and it is mentioned by Kæmpfer, that he beheld, in his journeys to and from court, hills and mountains, many of them inaccessible to cattle, which would lie wholly neglected in other countries, cultivated to their tops. The law on this subject is strict and severe, enforcing on all the cultivation of the ground as a sacred duty, and punishing the neglect of it by the forfeiture of the land. The flat grounds are ploughed with oxen, the steep and high ones by men; and, where they have the command of water, the rice-grounds are intersected by canals. The rent of the landlord is reckoned at six tenths of the gross produce; and, with the view of accurately estimating the amount, surveyors are appointed, who, before the harvest, compute the probable returns with surprising accuracy, with a view to a just division of the produce.

From the laborious culture to which they are subjected, the Japanese islands abound in a great variety of useful and beautiful trees and plants. Amongst the most curious and finest trees is the varnish tree. It affords a milky juice, with which the inhabitants varnish, or, as we call it, japan, all their dishes and plates of wood, from the emperor to the meanest peasant; for, even at court, services of lackered ware are preferred to those of gold and silver. The mulberry tree grows in most parts of Japan, especially in the northern provinces, where many cities and villages depend almost wholly on the silk manufactures, though the silk which they weave is not the finest, nor equal to the Chinese silk. The tea shrub is one of the most useful plants growing in Japan; it is planted round the borders of rice and corn fields, and in barren places unfit for the culture of other things. All ranks drink of an infusion from this shrub; and it is the custom of the country to present it when friends come to visit, both when they come and when they depart. The common people use the coarser leaves, the young and tender leaves being used by the higher classes. The laurel tree is common in Japan. That which bears red berries resembles the cinnamon tree in shape, and in the figure and substance of its leaves; but the bark wants the peculiar sweetness of the true cinnamon tree, an imperfection which Kæmpfer ascribes to the quality of the soil. The camphor tree is found in Japan; and the *sansio*, the leaves of which are eaten on account of their pleasant aromatic taste. Firs and cypress trees are common in the woods. They are planted in barren and sandy places which will produce nothing else, or along the roads, which makes travelling very pleasant. The wood is used in the construction of houses, ships, and household articles, and the branches for fuel. There are other hard woods, such as the oak, which is different from the European oak, and of which there are two varieties; and the iron tree, of which houses are generally built; and others that have a fine grain, and are used for cabinets, chests of drawers, &c. The baraban is common, and is of great use here, as also in India. Fruits in great variety and abundance are found in Japan; figs of different sorts, oranges, lemons, citrons, grapes, chestnuts, walnuts, nuts of different kinds, peaches, apricots, plums, brambleberries, strawberries, raspberries, &c. Cherry trees, apricot trees, and plum trees, are valued for the sake of their flowers, which, under proper culture, become large and luxuriant, and when they are in full blossom form a fine ornament around their temples, in their gardens, and in their walks, the trees being thickly covered with flowers, as with snow.

Japan is distinguished above all other countries for the great variety of beautiful plants and flowers which adorn its fields, hills, woods, and forests, and which, when they are transplanted into gardens, and improved by assiduity and culture, attain to a surprising degree of perfection. They mostly resemble either the rose or the lily. There is a large shrub, called tsubacki, which grows in woods and hedges, of which there are many beautiful varieties, and for which there are about 900 names in the Japanese language. Of the shrub called satsuki, with lily flowers, which is to be met with in the gardens, there are a hundred varieties. Sakanandsio, another shrub with lily flowers, of which there are only three varieties, is much larger than the former. There are numberless other flowers, some forming the chief ornament of houses and gardens, others of desert and uncultivated places. But of all these flowers, it is observed by Kæmpfer,[1] that as they exceed those in other countries in the show and exquisite beauty of their colours, they are greatly inferior to them in scent and fragrance. The same is also true of the fruits in Japan, which are far from equalling the pleasant aromatic taste of those which grow in China and other eastern countries.

The country is plentifully supplied with fresh water from the many fountains, lakes, and rivers which are scattered throughout the empire. There is no space in the country for the formation of great or navigable streams; but some of the rivers are so large and rapid, from the mountainous and rocky channels through which they make their way, and from the profuse showers of rain which frequently fall in the upper regions, that they are not to be passed without danger, arising from the impetuosity of their currents.

The climate of Japan, though it is upon the whole salubrious, is subject to frequent changes. The country lies without the range of the monsoons and the periodical rains; and accordingly it rains frequently throughout the whole year, but with the greatest profusion in the months of June and July, which are for this reason called the water-months. During the winter the ground is covered with snow, and there are often sharp frosts, whilst in the summer it is intolerably hot. At Nagasaki the thermometer ranges from 98° to 35°. Thunder and lightning are very frequent. Earthquakes are common, and happen so frequently that the inhabitants are familiarized to those dreadful phenomena when they are not uncommonly violent. Sometimes, however, the earth is shaken with so violent a commotion, which lasts so long, that whole cities are thereby destroyed, and many thousands of the inhabitants buried in the ruins. A great earthquake happened in the year 1586, when the earth yawned, and swallowed up one half of Nagafama, a small town containing 1000 houses; and the sea, violently breaking over its usual boundary, overflowed the rich and populous town called also Nagafama, and drowned all the inhabitants, besides destroying other smaller towns. Another occurred in 1703, by which, and by a great fire which happened at the same time, the whole city of Jedo was destroyed and laid in ashes, and about 200,000 inhabitants perished in the ruins. Some parts of these islands are entirely free from these concussions. Volcanoes are found in different parts of Japan, indicating the presence of those combustible materials which are imprisoned in the bowels of the earth, and which, suddenly bursting forth, and forcing an outlet, occasion earthquakes. Not far from Firando, where the Dutch had their factories before they removed to Nagasaki, lies a small rocky island, which has been burning and trembling for many centuries. Many mountains emit a perpetual flame. From the famous mountain of Fusi, which, Kæmpfer observes, is only surpassed in height by the Peak of Teneriffe, but "in shade and beauty hath not its equal," and which is covered with everlasting snow, a

[1] Vol. i. chap. ix. p. 119.

Japan. black stench and smoke is observed to issue, the remains of its half-extinguished volcano, which formerly burned with a brighter flame. In many places the soil is burning hot, and is besides so loose and spongy, that it makes a cracking and hollow noise under the foot. Hot and sulphureous springs abound in the vicinity of these burning mountains, and are prescribed as specifics in many complaints.

Minerals. Japan abounds in mineral wealth; in all the metals, besides various useful minerals. Gold is found in several provinces of the empire, and is smelted from its own ore. It is gathered from the sands of several of the rivers, and is also found combined with copper. The richest mine, which also yields the finest gold, is situated in one of the northern provinces in the great island of Niphon; and here also is a very rich gold sand, which the prince of the district causes to be washed for his own benefit. Next to these the gold mines of Surunga are esteemed the richest; and here gold is found in all the copper that is dug up. There are other mines, affording ore which is productive, and would repay the labour of working; but some of them are filled with water, and the uninstructed natives know of no process for drawing it off. Silver is found in different parts, particularly at Kattami, in one of the northern provinces; but it is not so abundant as gold. The metal which is most important to the trade of Japan, and is also most abundant, is copper. There are very rich copper mines in different provinces of the empire; in Surunga, Atsingo, and Kijnokuni. The copper found in the mines of the latter place is the finest, most malleable, and fittest for work, of any in the world; and in some cases, as already mentioned, it contains a considerable quantity of gold, in the refining of which the Japanese have greatly improved. All the copper is brought to Saccai, one of the five imperial towns, where it is refined and cast into small cylinders. These are packed up in square boxes, and sold at a high price to the Dutch, copper being one of the staple articles of export from Japan. There is besides a coarser sort of copper, which can be bought at a lower price than the other, being much inferior in quality and appearance. Brass is very scarce in Japan, and brings a much higher price than copper. A small quantity of tin is found, but so exceedingly white and fine that it is almost equal to silver. This metal, however, is little used in the country. Iron is found in very large quantities on the confines of three provinces. It is refined on the spot, and is cast into cylinders two spans in length. It is fully as dear as copper; and household articles, hooks, and cramp-irons in buildings or in ships, which in other countries are made of iron, are in Japan made of copper or brass. In dressing their victuals they use a particular sort of kettles or pans, made of a composition of iron. The art of making this composition has been lost, so that the old articles of this sort bring a high price.

Of mineral substances, sulphur is found in great abundance. It is dug up in a neighbouring island, which, from the great plenty it affords of this substance, is called Sulphur Island. This island was formerly considered as inaccessible, by reason of the thick smoke which was observed continually to arise from it. But this fear having been overcome, its produce now yields a revenue to the prince of Satzuma, of about twenty chests of silver per annum. Coal abounds in the northern and several other provinces. Salt is made of sea-water; and it does not appear that they have any mineral salt. Agates of several sorts, some of them extremely fine, of a bluish colour not unlike sapphires, as also cornelians and jaspers, are brought from the northern extremities of the great province of Osju, opposite to the country of Jedo. Naphtha is found in one of the rivers, and is taken up where the water has little or no run, by the natives, who burn it in lamps instead of oil. Some ambergris is obtained upon the coasts of Satzuma, and of the Riuku islands. It is found chiefly in the intestines of a whale which is caught frequently on the Japanese coasts, or floating on the surface of the sea, being torn up from the bottom by the violence of the waves. Pearls are found throughout almost the whole circuit of the island, in oysters and several other kinds of shell-fish; and every one is at liberty to fish for them. The largest and finest pearls are found in a small sort of oyster, called akoja, which is not unlike the Persian pearl shell, about a hand broad, exceedingly thin and brittle, and shining on the outside, but within of a whitish colour, and glittering like mother-of-pearl. All sorts of submarine plants, shrubs, corals, stones, mushrooms, sea-fans, corallines, fuci, algæ, and the like, as also shells of all kinds, are found plentifully in the Japanese seas, and nowise inferior in beauty to those found about Amboyna and the Spice Islands. These are, however, very little valued by the inhabitants.

Animals. Japan does not abound in animals, either wild or tame. This may be accounted for from the extent of cultivation, which leaves little room, and no great cover, for the wild animals; and the tame animals, not being used as food by the inhabitants, are not multiplied beyond the necessary uses for which they are designed. The horse serves for purposes of state, for riding, for carriage, and for ploughing. The breed is small; but some of them are not inferior in shape, swiftness, and dexterity to the Persian breed. A certain breed of little horses is very much esteemed. Oxen and cows are only used in ploughing and carriage. The people care nothing for milk or butter, which are not used as articles of food. They make use of a sort of large buffaloes, of an extraordinary size, with hunches on their backs like camels, for carriage and transport of goods. Of asses, mules, camels, and elephants, they know nothing. Sheep and goats were formerly kept at Firando by the Dutch and Portuguese, and might be bred in the country to great advantage if the natives were permitted to eat their flesh, or knew how to manage or manufacture their wool. They have few swine, and these few are brought from China, and bred for the use of the Chinese, who make an annual resort to these islands, and amongst whom they are in great demand. It is mentioned by Kæmpfer, that whilst he was in Japan, dogs had multiplied in an extraordinary degree, owing to the partiality of the reigning emperor for that animal, in consequence of his being born in the sign of the dog. Greyhounds and spaniels are not known. The wild animals are deer, bears, wild boars, hares, foxes (which the natives hold in abhorrence, supposing them to be animated by demons), monkeys, wild dogs, a small animal called itutz, of a reddish colour, another called tin, both living in houses, and lodging themselves under the roofs, and so tame that they may be ranked amongst the domestic animals. The whole country swarms with rats and mice; the former animal is frequently tamed, and taught to perform several tricks for the amusement of the inhabitants.

All the varieties of the feathered race are met with in these islands. The falcon species are found in great numbers in the northern provinces, and are kept more for state than sport. Ravens, cranes, herons, wild geese, ducks, pheasants, wood-cocks, wild pigeons, storks, snipes, sparrows, swallows, larks, nightingales, &c. are common. The crane is protected by the particular order of the emperor, and can only be shot by his express commands, and for his own especial use. There is a singular species of duck, which is distinguished by the most surprising beauty of plumage. The pheasants are also of uncommon beauty. Neither the common European crow nor the parrot is to be met with in Japan. Snakes are seen, some of them of an enormous size; and insects are numerous and troublesome, especially the white ant, which is known for its de-

Japan. structive qualities; also scorpions and other noxious reptiles.

The Japanese have invented, or borrowed from their neighbours the Chinese, a great many fictitious animals, which are either allegorical or connected with their mythology. The kirin is a winged quadruped of incredible swiftness, with two horns standing before the breast; its good nature and holiness are such that it takes care, even in walking, not to trample on any the least plant, nor to injure the most inconsiderable worm or insect. Besides this animal there are other chimerical creatures of the quadruped kind, to which the Japanese ascribe various imaginary qualities. Of these the dragon is the most remarkable, and the chronicles and histories of their gods and heroes abound in fabulous stories of this animal, which is also employed in the armorial bearings of the emperor. Foo is a beautiful large bird of paradise, somewhat resembling the phœnix of the ancients. It dwells in the higher regions of the air, and never descends, as the Japanese believe, to honour the earth with its blessed presence, except at the birth of an emperor, or at that of some such distinguished personage.

Government, laws, and institutions.

All our knowledge of the Japanese government and laws is derived from Kæmpfer and Thunberg, who accompanied the Dutch in their annual commercial visit to these islands, the one in the year 1690, and the other in 1775. The account of Kæmpfer is exceedingly full and accurate, and its accuracy is attested by Dr Ainslie, one of the British commissioners, who, in 1810, when the island of Java was in possession of the British, had been sent by Sir S. Raffles to accompany the Dutch ships on their annual visit to Japan. They were, however, strangers, ignorant of the language, and hence were but imperfectly qualified to describe with accuracy the political institutions of this state. Throughout all Asia pure despotism is the prevailing form of government, and to this Japan forms no exception; but, according to the accounts of Kæmpfer and Thunberg, it is subjected to the double rule of a spiritual and a political sovereign, the respective limits of whose jurisdiction and duties do not appear to be very distinctly marked. Kubo is the name of the secular, and Dairi of the ecclesiastical emperor. To the latter are paid almost divine honours; but the real power of the state appears to be vested in his political competitor. The power of the sovereign is supreme; it is restrained by no positive law, though, as in all despotic countries, it may be tacitly modified by custom and immemorial usage. The emperor, according to Kæmpfer, inherits, along with the crown, an absolute and unlimited power over all his subjects, from the meanest peasant to princes of the highest rank. As in all the eastern countries, where the art of government is in its infancy, the country is divided into large tracts of land, which are again subdivided into sixty-eight considerable provinces, and these again into 604 smaller districts or counties. The provinces are ruled by governors or princes appointed by the emperor. These governors are amenable, for the exercise of their delegated authority, to the supreme head of the empire, who may dismiss or banish them, and even inflict on them capital punishment. They are entitled to the revenues of their provinces, with which they maintain their rank and state, besides a military force for the maintenance of order, and out of which they also keep the roads in repair, and carry on all other necessary improvements. They are also bound to repair once in the year to the court, with all due splendour, and a great retinue, and to bring with them considerable presents, and, according to the jealous maxims of despotic countries, to leave their families constantly at the court as hostages for their allegiance. The residence of these princes is mostly in the large and maritime towns, or those situated on rivers; which are surrounded by walls and ditches, the prince's castle standing most frequently at the extremity of the town, defended by strong gates and high towers.

The ecclesiastical was at first the only ruler that governed the kingdom. But his generals, to whom he was obliged to confide the command of his armies, gradually usurped the real power, leaving to the high priest only the empty splendour of the throne. Syn Mu, the founder of the monarchy, flourished 660 years before the Christian era. He improved both the government and the laws of the country. The emperors of his race were usually denominated Dairi; and a hundred and nineteen Dairis have ascended the throne in succession from that period down to the year 1775, when Thunberg resided in Japan. For more than 250 years the authority of the Dairi, the old and lawful potentate of the country, has been confined chiefly to ecclesiastical matters, though he is still held in the same veneration as ever. His person is considered as too sacred to be exposed to the air and the rays of the sun, and still less to the view of any human creature, and he is consequently confined within doors; and when he goes out of his palace, he is generally carried on men's shoulders, that he may not come in contact with the earth. His person is accounted so sacred, that his hair, nails, and beard, are never suffered to be cleansed or cut by daylight, an opportunity being taken to perform these operations when he is asleep. He never eats twice from the same plate, nor uses any vessel a second time. They are invariably broken to pieces, lest they should fall into unhallowed hands. The right of bestowing titles of honour is to this day vested in the person of the ecclesiastical emperor, and is a source of revenue. Even Kubo, the name of the political emperor, is honoured by the titles which he receives from this sovereign pontiff of Japan. Those who have spiritual titles are distinguished, both at court and in the churches, by a particular dress, conformable to their rank and dignity. So august and holy is Dairi considered, that Kubo, though possessing the real power, is bound, either in person or by his ambassador, to pay him an annual visit, and to bring presents in acknowledgment of his title to rule in the state. At the court of Dairi literature is cultivated. It is the only university in the country where students are maintained and instructed. Poetry, history, and mathematics are here cultivated; and music is a favourite study, especially with the fair sex. Here it is that all almanacs are compiled. The secular emperor derives his revenues from a tax on the produce of the land. These have been estimated, though on no very certain data, to amount to a sum equal to L.28,000,000. But this is probably a gross exaggeration. The military force is estimated at about 100,000 foot and 20,000 horse, whilst the different governors of provinces maintain each a large force within his respective territory. There seems little occasion for so large an establishment of troops, as Japan, being separated from all other countries by a stormy sea, is in no danger of attack from ambitious neighbours. The descendants of Genghis Khan, who conquered China, also invaded Japan with a great army; but they were completely repulsed by the valour of the inhabitants. Since this period the Japanese have been engaged in war with the Coreans, but with little effect. The domestic peace of the country has, however, been occasionally interrupted by the rebellion of the provincial governors, or by a disputed succession.

Laws and police.

The laws, as among all the half-civilized states of Asia, are implacable and severe. Death is the appointed punishment for almost every crime, sometimes by decapitation in prison, and, for higher offences, by impaling on the cross. Fines they consider as unequal and unjust, because they are less severe on the rich than on the poor; and from this absurd notion they confound in one common punishment all the different shades of crime. Where a

Japan. murder is committed in a town or in the open street, not only the criminal, but his relations and dependents, and even neighbours or spectators, according as they have been more or less cognisant of the crime, or have not interfered to prevent it, are rendered amenable to justice. The master of a house is in like manner held responsible for his domestics, and parents for their children; and this cruel and bloody spirit pervades the whole system of their criminal justice. If one man draws his sword on another, it is a capital offence; and smuggling of all kinds is invariably punished with death, buyers and sellers being involved in the same penalty. Some offences are punished by perpetual banishment and confiscation of goods. Every criminal has a fair trial before the proper tribunal, and by a careful examination of witnesses. The prisons are gloomy and horrid abodes; they contain an apartment for trial by torture, another for private executions, a kitchen, a dining-room, and a bath. The towns are subjected to a very strict police, in which the same rigour prevails as in the administration of justice; and the consequence is, that, through the influence of terror, the most exact order prevails, each petty delinquent still incurring the penalty of death. Four officers are appointed in every town, of which number one presides every year. A commissioner is besides appointed for every street, who keeps an account of deaths, births, and marriages, and makes his report to the head officer. He has the power of casting offenders into prison, and of even putting them in irons; and he employs spies, who bring them accurate intelligence of all that takes place.

Religion. There are two leading religious sects in Japan, namely, the Sintos and the Budsdos; though there are numerous other sectaries who hold the most opposite tenets, and yet live together in the greatest harmony. The religion of the Sintos is the more ancient of the two, and seems to be a system of polytheism, which, along with one Supreme Being, acknowledges a crowd of inferior deities, and often of deified heroes, who are supposed to exercise dominion over the earth, the water, the air, and over particular districts, and to have the power of making men either happy or miserable. They believe in a state of future rewards and punishments. The souls of the virtuous, according to their creed, dwell immediately under heaven; whilst those of the wicked are doomed to wander on the earth for a certain period, in expiation of their sins. The chief points of the Sinto religion are inward purity of heart, abstinence from whatever makes a man impure, and a diligent observance of solemn holidays, and of pilgrimages to holy places at certain seasons of the year. They abstain from animal food, and from the uncleanness of a dead body, and are loath to shed blood. Their system of divinity, according to Kæmpfer, is such a tissue of monstrous and absurd fables, that their priests are ashamed of it, even in the presence of their own adherents. Their notions of the creation of the world resemble the wild extravagances of the Hindus. Kæmpfer heard a sermon by one of their priests, which he describes as a confused composition of ridiculous stories and fables about their gods and spirits. The devils, they imagine, reside in the bodies of foxes; and this animal is accordingly held in general abhorrence by them. They have churches, in which they attend for worship on stated holidays. In these temples they have no visible idols, nor any image to represent the Supreme Being. But in the centre is generally placed a large polished mirror of cast metal, the purpose of which is to impress on those who worship, that as the mirror reflects a faithful image of their person, so the secret faults and impurities of the heart lie open to the all-searching eyes of the immortal gods. They never approach those temples unless they are perfectly clean; and accordingly they wash themselves with water, and, putting on their best apparel, they bow respectfully to the ground, preferring their prayers, and presenting their offerings. Kubo, the emperor, belongs to this sect, and is bound to pay a visit every year, either in person or by his ambassador, to one of their temples, and to make presents of great value, which is accounted the essence of piety by the priests of Japan, as by all other priests in every age and country. The doctrine of Budsdo, identical with Buddha, whose votaries are spread over the East, was brought from Continental India into China, and thence introduced into Corea and Japan, and, being mixed with the existing doctrines and practices of Sinto, gave rise to the most monstrous superstitions. The Japanese follow Buddha's doctrine of the immortality of the souls of men and of beasts, of a future state of rewards and punishments, and of the transmigration of the souls of men into animals. The churches of all the different sects are adorned with alleys of cypress trees, and handsome gates; and most of them have a separate chamber for their idol, where he is exhibited sitting on an altar surrounded with incense, flowers, and other decorations. The churches are open every day, but there are festival days throughout the empire, which are more especially appropriated to religious worship by both Sintos and Budsdos. These are the first and last days of every month, the new moon, and the first day of the year, which last is spent in eating and drinking, visiting the temples, and making merry. There is, besides these priests, a holy order of men called Jammabos, or Monks of the Mountain, devoted to religious exercises and holy contemplation; and an order of blind monks, who are dispersed all over the empire. Religious vows are frequently made by devotees; and in this, as in many other points, the Japanese superstition resembles that of Hindustan and other eastern countries. It is related of one of these persons by Thunberg, that having made a vow never to make use of shoes, he actually accompanied the Dutch embassy to the imperial court, walking on his bare feet, though it was the depth of winter. Kæmpfer also mentions, that sometimes persons are met with in the streets running about quite naked, according to vows which they have made to visit in that state certain temples, provided they obtain by the mercy of the gods deliverance from some fatal distemper they themselves or their relatives have been subject to, or from other great misfortunes with which they are threatened. Multitudes of religious beggars, with their heads shaved, also crowd the streets; and to this tribe belong a singular religious order of young girls, who, if they be handsome and agreeable, easily obtain the privilege of begging in the habit of nuns. They watch particularly people of fashion, and accost them by singing a rural song; and if they prove liberal, they will accompany them for hours. Their voice, gestures, and apparent behaviour, are neither too bold nor daring; but free, comely, and seemingly modest. Kæmpfer, however, intimates his idea of their true character, under whatever specious appearances it may be disguised. Nunneries have been established in the country upwards of a thousand years. Besides these idolatrous devotees, there is a sect of philosophers, who deride the popular worship, and merely inculcate the duty of leading a holy and virtuous life, and the belief of one great first cause, the divine author of all things.

The Dairi is the spiritual head of the Sinto religion; and since the retrenchment of his power the secular emperor has granted for the maintenance of his state and dignity the whole revenue arising from the city of Miaco and the adjacent districts. He has likewise an allowance from the imperial treasury, besides immense sums which he derives from his privilege of conferring titles of honour. But these allowances are not nearly so great as when the Dairi possessed the secular as well as the eccle-

Japan.

siastical power, and they fall short of the necessary expenses of his court. Hence many of his retainers are compelled to work at menial employments to procure a livelihood; and Kæmpfer describes his court as being only remarkable for its splendid poverty.

Revenues.

The public revenue is derived, as far as we can gather from the necessarily imperfect accounts of those who have visited Japan, from a land-tax, and a tax on houses. The land is rated according to its produce, consisting for the most part of rice. The arable land is divided into three classes, according to its fertility; and the public tax amounts to more than one half, or even to two thirds of the produce. The land belongs to the crown, whose rights or claims none dare dispute; and unless the farmer cultivate it with care and attention, it is taken from him. In the towns each proprietor of a house is assessed in proportion to the breadth of his house towards the street, besides presents which are exacted from him by the civil officers, and taxes for the support of the temples and idols. The land-tax is collected by the receiver-general.

National character and manners.

The national character of the Japanese, as described by Kæmpfer, Thunberg, and others, has been corroborated by Dr Ainslie, who, by order of Sir Stamford Raffles, accompanied the Dutch in their annual visit to these islands in 1812. He describes them as a nervous, vigorous people, assimilated by their bodily and mental powers much nearer to Europeans than to Asiatics. The traits of a vigorous intellect are displayed in the greater progress they have made in the sciences and in the arts, which are carried to a much higher degree of perfection among them than among the Chinese, with whom they are frequently confounded, but to whom they consider it as a great disgrace to be compared; and the only occasion in which Dr Ainslie saw a Japanese surprised into a passion, and, relinquishing his habitual politeness, lay his hand on his sword, was on an unguarded comparison being made between the two nations. Thunberg represents the Japanese as frugal, ingenious, sober, just, and friendly; yet distrustful, superstitious, proud, and implacable in their resentments; never forgiving an injury, but carefully concealing their hatred, and patiently waiting the favourable moment for striking their victim to the heart. This deep-rooted malignity is a common feature in the character of all barbarous nations; and hence the feuds that we hear of among them are handed down from generation to generation. This spirit of revenge arises from pride, and that lofty sense of honour by which the Japanese are distinguished. Thunberg, in depicting the character of this singular people, appears to ascribe to them qualities which are scarcely consistent with their state of improvement. He speaks of a love of liberty, not that liberty, he adds, which degenerates into licentiousness, as being the passion of the Japanese, who nevertheless enjoy no freedom, but are subjected to cruel laws and to the caprice of a tyrant, at whose mercy they hold both their lives and properties. The love of freedom can scarcely exist in a community so degraded; it can only flourish amongst a refined people, guarded by equal laws against the violence of power. Ceremonious manners, another feature of a comparatively rude and ignorant people, are much cultivated by the Japanese. In courtesy and submission to their superiors, few can be compared to them. Inferiors are accustomed to bow to the class above them, lowly and reverently; a consequence, probably, of severe laws, and of the habitual bondage in which the lower classes are held by their superiors. But the intercourse between equals in rank is also encumbered with a variety of troublesome ceremonies; a sure mark that true refinement has made little progress, seeing that, as mankind gradually improve, they insensibly relinquish these impediments to social intercourse, as inconvenient and absurd. The Japanese are extremely curious and inquisitive concerning the manners and habits of strangers; they are continually asking the Dutch for information, and wearying them with questions. It is related by Thunberg, that during the audience they had of the emperor, they were surveyed from head to foot by privy councillors and others, the higher officers of the state. Their hats, swords, clothes, buttons, lace, watches, and other articles of dress, were duly examined; and they were requested to write in the presence of the courtiers, that they might see the European characters and mode of writing. They are of friendly dispositions, of frugal and industrious habits, and honest in their dealings. Highway robberies are unknown, and thefts are seldom heard of, which perhaps may be partly ascribed to the severity and unrelenting vengeance of their laws. Dr Ainslie agrees with former writers in his representation of the Japanese as exhibiting an apparent coldness, like the stillness of the Spanish character, "eager of novelty, and warm in their attachments, open to strangers, and, bating the restrictions of their political institutions, a people who seemed inclined to throw themselves into the hands of any nation of superior intelligence. They have at the same time a great contempt and disregard of everything below their own standard of morals and habits, as instanced in the case of the Chinese." Nor, according to Dr Ainslie, is that uniformity observable amongst them which prevails amongst the Chinese, where the heavy hand of the government may be said to have broken down all individuality, and left one Chinese the counterpart of another. Unlike the Chinese, also, and unlike all other eastern nations, women are not immured at home; they go abroad like the ladies in Europe, and mix freely in society. Whilst Dr Ainslie resided at Nagasaki with the Dutch, frequent invitations and entertainments were given; and at one of these entertainments a Japanese lady from the court of Jedo is represented to have done the honours of the table with "an elegance and address that would have graced a Parisian."[1] In many important points they appear to have been misrepresented by the Dutch, for their own interested purposes. That their illiberality in religious matters, and their hatred and intolerance of Christianity, have been greatly exaggerated, is fully proved by the mission of Dr Ainslie. The story told of the annual ceremony of trampling on the crucifix as a test of their abhorrence of the Christian faith, was derided as a fable when it was mentioned to the priesthood. The Japanese were formerly adventurous navigators; they served as mercenaries throughout all Polynesia, and traded with all nations. They undertook voyages in their own vessels to Corea, China, Java, Formosa, and other places. They have since adopted an entirely different policy, and have rigidly forbidden all intercourse with other nations; and being in this manner confined within the limits of their own territory, their voyages are all along the coast, in trading vessels of different sizes, and in fishing smacks. The art of navigation has accordingly declined; and though they are provided with a mariner's compass, they seldom venture to lose sight of land. The natives are prohibited, on pain of death, from leaving their country, or from encouraging the visits of foreigners. The reasons of state which have induced the government to act upon these illiberal maxims are not well understood. Certain it is that the people do not participate in this jealousy of foreigners; they would willingly trade with them, and on all occasions evince the most frank and so-

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[1] *Life of Sir Stamford Raffles*, p. 182, 4to edit. chap. vii.

cial dispositions. There is every reason to believe that this aversion of the Japanese government to all intercourse with strangers has been aggravated by the interested misrepresentations of the Dutch, anxious to monopolize the lucrative trade of Japan, and to banish all competition, by instilling into the rulers of the country a jealousy and a dread of all other Europeans. The ill treatment experienced by the mission from Russia in 1814, under Count Kreusenstern, is ascribed to the exclusive influence of the Dutch factory, who continued to "rain upon them," says Dr Ainslie, "through the medium of an interested and avaricious factor, who dreaded competition, every possible ignominy which can be supposed to have flowed from the despotism of Japan." They were lodged in a warehouse, which was pointed out to Dr Ainslie, who observes, that as "the rats were let out, the count and his suite were let in, where they remained for six long months, with scarce room to turn, the mark of obloquy to the Japanese, and the laughing-stock to the European factory." So deep an impression did the degrading treatment of the Russian embassy, and their meanness in submitting to it, make on the Japanese, that the chief officer asked the English commissioner if he would condescend to play the part of the Russian count; and, answering his own question, said, "No, I trust not." The insolence of the semi-barbarous nations of the East, such as the Japanese and the Chinese, which naturally leads them to trample on their European visitors, is best opposed by a spirited conduct, which inspires respect. Mean submissions, far from conciliating, only provoke fresh aggressions; as has been often proved in the intercourse of the Europeans with both Japan and China.

The Japanese are a proud, a brave, and a warlike people. Their arms consist of bows and arrows, scimitars, and guns. Their bows are very large, and their arrows long; and in discharging them the troops always drop down on one knee. Guns are not their usual weapons; and Thunberg mentions, that during all the time he was in Japan he never saw one discharged. They have cannon, but these are only fired every seven years; and so inexpert are the gunners, that they provide themselves with a long pole, and stand with averted eyes when they are firing off the gun. The scimitar, which is constantly worn by every one but the peasants, is their trusty weapon; it is a yard in length, of an incomparably good temper, and far surpassing the Spanish blades, which are so much renowned in Europe. With this weapon a Japanese will cleave his adversary asunder at a blow. In sciences and the useful arts the Japanese are far behind the Europeans. They study astronomy, but are unable, without the aid of the Chinese and Dutch almanacs, to compute a perfect calendar. They have made little or no progress in natural philosophy and chemistry, and even the scanty knowledge which they have acquired is borrowed from Europe. They appear to have studied botany and zoology with more success; and they have extensive works on these sciences, in which all the indigenous plants and animals are described, and exhibited in well-coloured plates. They have studied surveying, and possess maps of their own country, and of its towns, which are sufficiently accurate in topography, but without the divisions of longitude or latitude. When Dr Ainslie was at Nagasaki, a large detachment of officers of rank had just arrived, with a numerous and splendid retinue, who had been four years engaged in making a practical survey of every part of the empire and its dependent isles. "The survey," says Dr Ainslie, "appeared to be conducted on a scientific plan, to be most minute and accurate in its execution, and to have for its object a regular geographical and statistical survey of the country."[1]

Nor are their literary acquirements inconsiderable. They study the history of their own country, and their annals are said to be more authentic than those of most other eastern nations. They have also translated several European works, and appear to be familiar with the account which Kæmpfer gives of Japan, as they observed to the English commissioner, Dr Ainslie, that he was the very apostle of their faith, from whose works they knew even their own country. They have a college for interpreters, who study foreign languages; and it is an extraordinary fact, that, notwithstanding the determination of the empire not to enter into foreign commerce, an edict of the emperor has been issued, enjoining on the college of interpreters the study of the English language; and it has accordingly been cultivated with success by the younger members of the college, who are extremely anxious in their inquiries after English books. Amongst other works in the English, they showed to Golownin, Benyowsky's Conspiracy and Escape from Kamtschatka; an Account of the Expedition of the Russians and English to Holland in 1799; and a Geographical Description of the Russian Empire. The art of printing has long been known amongst the Japanese. They have also some knowledge of engraving; but in the art of drawing they are greatly inferior to Europeans. Poetry is employed by them chiefly to perpetuate the memory of their gods and heroes; and though music is held in high estimation amongst them, they have neither brought their musical instruments to any degree of perfection, nor do they understand musical science or harmony.

Although the Japanese in general are grave in their demeanour and manners, yet they frequently indulge in sports, festivities, and theatrical amusements. They have stated religious festivals, sometimes in honour of a particular god, which they celebrate not merely with devotional exercises, such as sermons and prayers, but with games, processions, public dances, and dramatic representations. These last are of the lowest description, consisting of exhibitions calculated rather to terrify than to entertain the audience. Artificial contortions of the body, and uncouth and extravagant dresses, seem to make up the whole amusement on these occasions. The story is generally some heroic exploit, or some adventure of their idols and heroes, composed in verse, and accompanied with music; diversified with low juggling tricks, which appear to be well adapted to the capacity of the audience. There are no decorations or machinery, nor any thing in these exhibitions which can put them on a level with the theatrical amusements of Europe. Weddings and funerals are celebrated with great pomp and many ceremonies, though the ceremony by which the married pair are united is short and simple. The bridegroom and bride advance together to an altar erected for the purpose, each holding a torch; and whilst the priest recites a form of prayer, the bride lights her torch from a burning lamp, and holds it to the bridegroom, who lights his torch from hers; upon which the guests congratulate the new married couple. Their manners are far from being pure. Many of the women live for a time with Europeans and others, receiving the wages of prostitution; and afterwards, in the full knowledge of their character, they are well married. The Japanese either bury their dead in the earth, or burn the body to ashes. The latter method is not so common as formerly, but is still practised by persons of distinction.

Public schools are established, in which children are in-

[1] See *Life of Sir Stamford Raffles*, p. 184.

structed in reading and writing, and are educated without chastisement or blows.

In many arts and manufactures they have made great progress, and some they have brought to such perfection as even to surpass those of Europe. They excel in the manufacture of copper, iron, and steel, of which the temper of their swords affords the best proof; and their silk and cotton manufactures are greatly superior to those of the other eastern countries. Their lackering of wood, especially the ancient workmanship in this line, and which derives its name from their country, surpasses every attempt at imitation by any other nation. Their lackered ware consists of the finest sort of firs and cedars, whieh they cover with the very best varnish, prepared from the *rhus vernix*, a tree that grows abundantly in many parts of the country. This varnish, which oozes out from the tree on its being wounded, is of so transparent a nature that every vein of the wood may be distinctly seen through it. In general a dark ground is spread under it, which causes it to reflect like a looking-glass; or it is mixed with some darker substance, and sometimes with gold leaf ground very fine, and is embellished with gold and silver flowers, and figures laid on upon the varnish. All articles made of wood, drawers, chests, boxes, scimitars, fans, tea-cups, and soup-dishes, the posts of their doors and windows, and most articles of household furniture, are covered with this varnish. They are acquainted with the art of making glass, coloured as well as uncoloured; they also grind glass for telescopes, for which purpose they purchase mirror-glass of the Dutch. Paper of all sorts is manufactured abundantly in the country, both for writing and printing, as well as for tapestry; and all coarser qualities for the packing of goods. It is prepared from the bark of a species of mulberry tree, which, by an ingenious process, is reduced to the consistence of a fine pulp, from which the sheets of paper are obtained. Japanese porcelain or china ware is manufactured out of a whitish fat clay, which is found there in great plenty. This clay requires a great deal of kneading, washing, and cleaning, before it acquires that degree of transparency which is the perfection of china ware; and the manufacture is altogether so laborious and troublesome, as to have given rise to the saying, "that human bones are an ingredient of China ware."

The temperature of the Japanese islands is in general salubrious. The most common diseases are colic, occasioned by the immoderate use of rice beer, which occasions violent pains, and often leaves behind it swellings in different parts of the body, and is especially productive of the hydrocele; red and watery eyes, occasioned amongst the poorer classes by the smoke in their confined apartments; and indurated glands, which frequently turn to cancers, dysenteries, small pox, measles, rheumatism, gout, pleurisy, water in the head, and certain eruptions on the skin. The physicians have no great knowledge of medicine, and their remedies consist generally of decoctions, diuretic or sudorific. Some profess only medicine, others the cure of internal disorders; and others, again, practise surgery, though they have no knowledge of anatomy. There is a class of persons for puncturing with needles, or for burning with a powder made from the dried leaves of a particular tree called *moxa*, which, being laid on the body, is set on fire, and burns the skin, leaving a scar behind it. Those who perform the operation of puncturing with needles may be heard in the evening patrolling the streets, and making a tender of their services with great noise and vociferation. The burning with *moxa* and puncturing with needles are supposed to be efficacious both for the prevention and cure of diseases; and they are resorted to by all classes, by rich and poor, old and young, especially in cases of pleurisy, gout, rheumatism, and toothach.

The Japanese, in selecting their food, range over the whole of the animal and vegetable kingdoms, using not only what is wholesome and nutritive, but some articles also which are poisonous, though, by their mode of preparation, they contrive to render these not only harmless, but useful. Their meat is always cut into small pieces, thoroughly boiled and stewed, and mixed with agreeable sauces. They sit at meals on soft floor mats, with a small square table before each guest; and the meat is served up in the neatest vessels, either of porcelain or japanned wood, furnished with a lid. The servant who attends kneels down as he places the dishes on the table and takes them away after dinner. They drink the soup out of the cup in which it is served; and they eat the solid parts of the meat with two lackered pegs, which they hold so dexterously between the fingers of the right hand, that they can with the greatest nicety take up the smallest grain of rice, these pegs serving them as both fork and spoon. The company, before beginning to eat, salute each other with a low bow; and the ladies, says Thunberg, eat separately from the men, though this scarcely agrees with Dr Ainslie's account of the lady whom he commends for doing the honours of the table at an entertainment where he was present, with all the grace of a Parisian. Tea and rice beer are the only liquors used by the Japanese. Wines or distilled liquors are never seen amongst them; and they can hardly be persuaded to taste them, even when they are offered by the Dutch. Their only inebriating drink is sacki, which, being warmed in a common tea-kettle, is poured out into flat tea-cups made of lackered wood, and is in this manner drunk quite warm. Tea is drunk at all times of the day.

The dwelling-houses of the Japanese, whether public or private, are by no means to be compared to those in Europe, either for size or magnificence, being commonly low, generally consisting of one story, and built of wood, owing to the danger of earthquakes. Their apartments are small, but uncommonly neat and clean, and for the most part carefully and curiously furnished; the windows, doors, posts, and passages, are finely painted and varnished; and the ceilings neatly covered with gilt or silver-coloured paper, and embellished with flowers. They have few partition walls to divide the rooms from one another; but instead of these they use folding screens made of coloured or gilt paper, laid into wooden frames, which they can put on or remove at pleasure; and by this means they enlarge their rooms or make them narrower as best suits their fancy or convenience. These houses are built of cedar wood, of which there is great abundance in the country. The castles of the Japanese nobility are built either on great rivers or upon hills and rising grounds, and occupy a large space, consisting of three different fortresses or enclosures, which either cover or defend, or, if possible, encompass one another. Every enclosure is surrounded by a deep ditch, kept clean, and a thick strong wall built of stone or earth, with strong gates. The towns are mostly populous and well built; and the streets run straight forward, crossing at right angles. They have no fortifications. The two chief gates are shut every night. The villages along the highways are but thinly inhabited. The houses of the country people and husbandmen are small and poor, consisting of four low walls, covered with a thatched or shingled roof. "They have," says Kæmpfer, "many children and great poverty, and yet, with some small provision of rice, plants, and roots, they live content and happy." The temples dedicated to Buddha, or to other foreign idols, are far superior to all other buildings, for their great height, curious roofs, and numberless other beautiful ornaments. They are built of the best cedars and firs, and adorned with carved images of their idols. A fine altar stands in the middle of the temple, with one or more gilt idols on it, and a beautiful candlestick with sweet-scented candles burning before it. The best situations in the country are chosen for these temples; those which afford a fine view of the adjacent country, or are in the vicinity of a spring, a rivulet of clear water, or a wood with pleasant walks.

There are excellent roads throughout Japan, so broad and large, that two companies, however numerous, can pass each other with ease. The country is divided into seven large provinces, every one of which is bounded by a highway; and all the smaller provinces into which the country has been subdivided are in like manner bounded by highways, which all lead into the greater, as a common centre, and unite at Jedo, the capital of the kingdom and the residence of the emperor. These highways are divided into measured miles, so that a traveller, in whatever part of the empire he may be, can ascertain at a glance his exact distance from the imperial residence. Bridges are laid over all the large rivers after they emerge into the plains; but they have no means of crossing the mountainous streams, which roll with too rapid a current to admit the building of arches, except by fording them. They have not the art of throwing across a bridge from bank to bank, or of even constructing rope bridges, which is the common resource in such cases in all mountainous countries, in the South American Andes, and amongst the Himalaya Mountains. The number of travellers on the roads, according to Kæmpfer, is scarcely credible, owing chiefly, as he supposes, to the populousness of the country, and to the frequent journeys undertaken by the natives. The princes and lords, who are bound to go once a year to pay their court to the emperor, commonly travel with great pomp and magnificence, and with a train which fills up the road for some days, consisting, for the first order of princes, of twenty thousand men; of ten thousand for one of the second order; and thus diminishing according to the quality or revenues of the nobles. This retinue is made up of numerous troops of forerunners, harbingers, clerks, cooks, and other inferior officers, whose duty it is to provide lodgings and victuals for the approaching train. The prince's heavy baggage follows, suitably attended, and carried in small trunks packed on horses, each bearing a banner with the coat of arms and name of the possessor. Then follow the chief officers and noblemen attending the prince, with pikes, scimitars, bows and arrows, umbrellas, palanquins, led horses, and other marks of grandeur. The prince himself is carried in a palanquin by six or eight men clad in rich liveries, sixteen pages, who are persons of the first rank, and richly clad, walking before, and others by his side; whilst the rear of the procession is brought up by numerous domestics, grooms, footmen, pike-bearers, all in liveries, and by numbers of led horses. The whole train are clad in black silk; and they march in order, in profound silence, without any noise except what is occasioned by the trampling of horses and men. On the other hand, the etiquette is, that the pike-bearers, and the carriers of the palanquin, have their clothes tucked up above the waist; and thus their naked bodies are exposed to view, with only a small piece of cloth for the sake of decency. What appears still more odd and whimsical to a European is, that the pages, pike-bearers, umbrella and hat-bearers, chest-bearers, and footmen, affect a strange mimic march or dance when they pass through any remarkable town or borough, or by the train of another prince or lord. Every step they make they draw one foot up behind them as high as their back, and stretch out the arm on the opposite side as far as they can, "putting themselves in such a posture," says Kæmpfer, "as if they had a mind to swim through the air." The roads are besides crowded with numerous travellers, with pilgrims going on their annual visit to some holy temple, and with multitudes of beggars, in which character, indeed, many of the pilgrims travel. There are on all the roads idols of stone erected in honour of their gods, and other monstrous images and idols which occur on the highways in several places, at the turning in of sideways, near bridges, convents, temples, and other buildings. Coarse figures of these idols are also printed on entire or half sheets of paper, and pasted upon the gates of cities and villages, on wooden posts near bridges, and in other places on the highway most exposed to the traveller's view. But strangers are not expected to pay these idols any sort of homage. The Japanese are, contrary to the representations given of them, tolerant and liberal in matters of religion. The mission which was sent to Japan by Sir Stamford Raffles, and which Dr Ainslie accompanied, experienced this liberality in a manner that they by no means expected from the representations previously made to them. The English commissioner visited the great temple on the hills of Nagasaki, and was received with marked regard by the venerable patriarch, who entertained him sumptuously. On showing him round the courts of the temple, one of the English officers present, as mentioned by Dr Ainslie, heedlessly exclaimed in surprise, "Jesus Christus." The patriarch turning half round with a placid smile, bowed significantly, as if intimating that he was perfectly aware of the difference of their respective creeds; and they parted mutual friends, with a hearty shake of the hands.

For the accommodation of travellers, there is in all the chief villages and hamlets a post-house belonging to the lord of the place, where are procured horses, porters, footmen, or whatever else may be wanting for their journey, at settled prices. Travellers of all ranks and qualities resort to these post-houses, which lie at about one and a half to four miles distance from each other. They appear to have no carriages, but either travel on foot or on horseback, or along the coast by sea. At these post-houses messengers are walking day and night, in order to carry the letters, edicts, and proclamations of the emperor and the princes of the empire, which they convey from one post-house to another with all speed. Two messengers are always employed on these occasions, that in case any accident should befal the one, the other may forward the despatches, which are kept in a varnished box bearing the arms of the emperor, to the next stage; and all travellers, and even princes of the empire and their retinues, must retire out of the way in order to give a free passage to these messengers.

The Japanese are represented as a vigorous people, both in their bodily and mental habits. They are well made, active, free, and easy in their motions. The men are of the middling size, and in general not very corpulent. They are, says Thunberg, of a yellowish colour all over, sometimes bordering on brown, and sometimes inclining to white. The labouring classes, who, in summer, when they are at work, lay bare the upper part of their bodies, are sun-burnt, and consequently brown. Their features are masculine and perfectly European, with the exception of the small lengthened Tartar eye, which almost universally prevails, and is the only feature of resemblance between them and the Chinese. Dr Ainslie gives rather a different account of their complexion from Thunberg. He represents them as perfectly fair, and indeed blooming; though this seems to apply chiefly to the women, who, he says, are equally fair with Europeans, and have the bloom of health more generally prevalent amongst them than is usually found in Europe. Thunberg also mentions that ladies of distinction, who seldom go out in the open air without being covered, are perfectly white. Their eyes are generally dark-brown, or rather black; and the deep furrow which the eyelids form in the great angle of the eye discriminates the Japanese

Japan. from other nations. They have generally large heads and short necks, with black, thick, and shining hair, from the oil which they put upon it. Their noses are rather thick and short, though by no means flat.

The dress of the Japanese is a complete uniform, from the monarch down to the lowest of his subjects; it is the same in both sexes, and has been unchanged for the space of more than two thousand years. It consists everywhere of long and wide gowns, one or more of which is worn by all ranks. The dress of the poor is distinguished from that of the rich only in the materials being made of cotton instead of the finest silken stuffs, which are frequently flowered, and sometimes interwoven with figures in gold. They reach down to the feet, and are frequently worn by women of quality with a train. Travellers, soldiers, and labouring people, either tuck them up, or wear them so short that they only reach to the knees. These gowns are fastened about the waist with a belt, which is of such a length as to go twice round the body with a large knot and rose, which is worn by the married women before, and by the single behind. To this belt the men fasten their sabre, fan, tobacco-pipe and pouch, and medicine-box. The gowns are rounded off about the neck; they are open before, and display the bare bosom. The sleeves are ill shaped and wide, and sewed together in front so as to form a bag at the bottom, in which they put their hands in cold weather, or use it as a pocket to hold their papers and other things. They wear, besides, breeches, which are more like a petticoat than breeches, being sewed between the legs, and left open at the sides for about two thirds of their length. There is, besides, a dress of ceremony, which is worn on the outside, over the gowns. It consists of two pieces; the undermost the above-described breeches, which are generally made of a blue stuff, printed with white flowers; the uppermost is a frock, not unlike a half gown. Besides silk and cotton, they use a kind of linen, which is manufactured from a certain species of nettles. The silk worn by the richer classes far exceeds in tenuity and fineness the silks either of India or Europe. The shoes are the most indifferent part of the Japanese dress.

Of the population of Japan no accurate account has ever been obtained, and all our information on this subject is merely conjectural. Every spot is cultivated even to the mountain tops; and all Europeans who have ever visited Japan concur in representing it as extensively populous. On these grounds, and taking into account also the area of the country, it is supposed that the population cannot be less than fifteen or twenty millions. Sir Stamford Raffles' estimate, from the accounts brought to him by Dr Ainslie, is twenty-five millions.

History. It was from the Portuguese that the nations of Europe received the earliest accounts of the Japanese islands. The mariners of Portugal first adventured on the Indian Ocean in the year 1497, and they long carried on a lucrative commerce in the ports of the East. The conquest of Goa by Albuquerque, in the year 1510, laid the foundation of their future power; and from that time they pursued with success their conquests and discoveries in the East, and carried on an extensive trade. In 1542 one of their ships was forced by a storm on the yet unknown islands of Japan; and afterwards a ship, richly freighted, sailed every two years for one of their ports. In 1549, a young Japanese, who had fled to Goa, and there embraced the Christian faith and was baptized, held out to the Portuguese the most sanguine prospects of gain from a trade to Japan, and even gave hopes to the Jesuits of converting the people to the Christian faith. These pious fathers were not slow to profit by the hints of their new proselyte; and, with a view to a permanent establishment in Japan, the young Japanese was sent back to his own country on board a Portuguese ship, accompanied by several of the Jesuits, and by St Francis Xavier, the head of the mission. At that time no restraint was imposed on the intercourse of the Japanese with foreign states; the Portuguese were therefore allowed to trade with whatever parts of the empire they thought fit, and were much caressed by several of the princes, and invited to settle within their territories. The princes and nobles of the country vied with each other to obtain the favour of the strangers, and a most lucrative trade was carried on in European and Indian commodities, such as raw silk, fine silk stuffs, drugs, wines, medicines, and a great variety of other productions, both natural and artificial, which were exchanged for gold and other produce or manufactures of the country. By this traffic the merchants were enriched, and in a few years carried off a large amount of treasure, though not perhaps three hundred tons of gold every year, as Kæmpfer says, with a boldness of assertion not very consistent with his usual caution and accuracy. The Jesuit missionaries on their part were not idle. They laboured diligently in their vocation, and they commended the doctrines of the gospel by their modest and virtuous life, and by their disinterested benevolence to the sick and the poor; whilst the pomp and majesty of the Catholic service arrested the attention and affected the senses of the Japanese. The first difficulties being surmounted, converts began to flow from all quarters; and many of the princes and nobles, being converted to the new doctrines, were baptized, and agreed to send an embassy to Pope Gregory XIII. with letters and presents, assuring him of their devotion to the Christian faith. In this manner the Portuguese prospered in all their concerns, both spiritual and temporal; and fresh supplies of missionaries and merchants from Manilla, Macao, and Goa, daily flocked to this profitable mart of religion as well as of trade. But the fair prospect was at last overcast by the darkest clouds of bigotry and persecution; the Christian faith, which had been so successfully planted and propagated, was rooted up and completely extirpated; and, instead of the free intercourse formerly allowed with all nations, commerce was placed under the most severe restraints, and was finally restricted to one part, that of Nagasaki, and to two nations, the Chinese and the Dutch.

This great revolution originated in various causes. The great prosperity of the Portuguese appears to have filled them with insolence and pride; the priests and others no longer walked on foot, but, being carried about in stately chairs, mimicked in this and other matters the pomp of the pope and cardinals at Rome; whilst the Japanese priests, and others who profited by the prevailing religion, were displeased at the alterations which had been introduced, being fearful of the injurious consequences to their interest, and contrived to instil into the emperor a jealousy of the new sect. It is related of one of the Portuguese priests, that having met on the road one of the counsellors of state, the haughty prelate would not allow his chair to stop, according to the fashion of the country, in order to pay respects to the great man, but commanded his men to pass on without even showing him common marks of civility. This neglect inspired the nobleman with an unconquerable hatred of the Portuguese; and, in an interview with the emperor, he gave such an odious picture of the insolence, pride, and vanity of the whole nation, as raised the emperor's indignation to the highest pitch. In 1586 a proclamation was issued by the emperor, forbidding any of his subjects, under pain of death, to embrace the Christian religion; and the same year began the persecution, which is the most sanguinary every recorded in any age or country. Several converts were executed for disobeying the imperial commands; and, according to the letters of the Jesuits, more than twenty thousand persons suffered death in the year 1590. Still the converts increased, for in 1591 and 1592, after all the churches had been shut up, twelve thousand new converts were made. In 1597 a new persecution was raised against the Christians, and twenty-six persons, including Jesuits, and several of the Franciscan fathers, were executed on the cross. It happened that the crown was about this period usurped by an adventurer of the name of Ijejas, whose doubtful title conspired with his fears and jealousy of the Christians to render him a cruel persecutor. He issued a proclamation, strictly forbidding the Portuguese missionaries any longer to preach the Christian faith; and directing all the governors, princes, and lords in the several provinces of the empire, to induce their subjects, either by force or persuasion, to renounce the Christian and adopt their former faith. The monks and priests already in the country were banished, and the Portuguese were strictly forbidden to bring any more of them to Japan. These orders, however, were not at first rigidly enforced. The Jesuits could not be persuaded to quit a country where their labours had been so successful in gaining both wealth and proselytes; and fresh supplies of ecclesiastics were still brought from the Portuguese settlements. But the rashness of the Franciscan friars, who were ambassadors at the imperial court, and who insisted on openly preaching in the streets of Miaco, and built a chapel, in direct opposition to the edict that had been published, hastened the total ruin of the Portuguese interests in Japan. Many were also disgusted by their ambition and covetousness, when they saw that these spiritual fathers aimed fully as much at the possession of money and lands as the salvation of souls. From all these various causes a dreadful persecution was commenced against the Christians, who were put to death without mercy wherever they were found. This persecution lasted forty years, and, after the cruel butchery of thousands, ended at last in the total extirpation of the Christian faith, the ruin of the trade, and the final expulsion of the Portuguese and Castillians from Japan. It was long before this last severe measure was resolved on, as the Japanese, however intolerant in matters of religion, were still anxious to obtain the commodities of Europe; and they appointed the island of Desima, in the harbour of Nagasaki, as the residence of the Portuguese merchants. But the Dutch, who some time prior to the year 1600 had extended their navigation to these seas, were now the zealous competitors of the Portuguese and Spaniards for the eastern trade; and the two nations being at this time at war, were not scrupulous in using the most unworthy arts to supplant each other in the good opinion of the Japanese. It is asserted by Kæmpfer that the Portuguese invented the most malicious stories in order to blacken the character of the Dutch, representing them as rebels and pirates, and altogether unworthy of trust. The Dutch on their part resorted to the same artifices, and with some success. It is stated, that in a Portuguese ship which was taken by the Dutch, they found letters to the king of Portugal, written by one Captain Moro, a Japanese by birth, and a Christian proselyte, containing the scheme of a conspiracy for overthrowing the existing government. The Dutch were not slow to profit by this precious discovery. They immediately communicated the letters to the Japanese authorities. Captain Moro was arrested, and, notwithstanding the most earnest protestations of innocence, was burned alive. In proof of the Portuguese treason, intercepted letters were shown, disclosing, as was alleged, the whole plot against the emperor's life and throne; the want the conspirators stood in of ships and soldiers, which were expected from Portugal; the names of the Japanese princes concerned in the conspiracy; and various other particulars, which were received as convincing evidence of this extensive treason. On this discovery the edict was forthwith issued, in 1637, forbidding, on pain of death, all intercourse with foreigners; prohibiting, under severe penalties, the propagation of the Christian religion, and the purchase of any article by a native of Japan from a stranger; banishing all the Portuguese to Macao, and shutting out for ever all other nations from the Japanese islands.

The Portuguese and Spaniards still lingered, in hopes of mitigation of this severe decree; but the Japanese court, being assured by the Dutch that they would supply them with European goods, proceeded to a rigorous execution of the edict, and from this period the trade of Japan has been entirely confined to the Dutch. An attempt to renew the trade, by sending an embassy from Macao, entirely failed, the ship being seized, and the crew executed, with the exception of twelve, who were sent back to their countrymen with an account of this tragical result, but who perished on their way home. It appears to have been chiefly by the intrigues of the Dutch that this great revolution was brought about. The persecutions to which the Portuguese were exposed might naturally enough have engaged them in plots against the Japanese government; but the whole story rests on the evidence of the Dutch, the rivals of the Portuguese, whom they were anxious to ruin, without much scrupling at the means of attaining their end; and in revealing the plot which produced an edict for the extirpation of the Christian faith, and the massacre and banishment of thousands of Europeans, it is plain that they were actuated by the basest motives.

By the ruin and expulsion of the Castillians and Portuguese from Japan, the Dutch acquired the monopoly of the trade, which they were so intent on securing that they cultivated the favour of the Japanese monarch by the most servile and criminal compliances. Their conduct was indeed most degrading. They made presents to the imperial court, of all the rare animals they could collect from the most remote quarters of the world; and they complied with all the commands of the emperor, however despotic or unjust. They were obliged, in 1638, to abolish their factory on the island of Firando, for no other reason but because it was built of hewn stones, and finer than the other buildings of the country, and because the Christian era was engraved on the front; and the part which they acted in the massacre of the Japanese Christians at Simabara leaves a deep stain on the national character, proving as it does that the love of gain had extinguished every sentiment of humanity in the breasts of these traders. The Japanese Christians, by the unparalleled cruelties and torments to which they were exposed, were driven to despair; and they had retired, to the number of forty thousand, to a fortified place in the neighbourhood of Simabara, where they were resolved to defend themselves to the last extremity. The emperor requested the aid of the Dutch in the siege of this last stronghold, in the massacre of these Christians, and in the utter extirpation of the Christian name in Japan. This aid was at once afforded. A Dutch vessel of war was sent to batter the town, and a breach was made in the defences of these unfortunate refugees, through which their enemies entered and perpetrated a massacre unparalleled for enormity even in the blood-stained annals of the East. According to the information received by Dr Ainslie from the Japanese, they were prompted to this massacre by European intrigue; and the alacrity of the Dutch in lending their aid, joined to their hatred of the Portuguese, concurs to fix on them a deep share in this shocking atrocity. But they were far from recommending themselves to the Japanese by their treacherous conduct. "By this submissive readiness," says Kæmpfer, "to assist the emperor in the execution of his designs with regard to the final destruction of Christianity in his dominions, 'tis true indeed that we stood our ground so far as to maintain ourselves in the country, and to be permitted to carry on our trade, although the court had then some thoughts of a total exclusion of all foreigners whatever. But many generous and noble persons, at court and in the empire, judged quite otherwise of our conduct, and not too favourably for the credit we had thereby endeavoured to gain. It seemed to them inconsistent with reason that the Dutch should ever be expected to be sincerely faithful to a foreign monarch, and one, too, whom they looked upon as a heathen prince, whilst they showed so much forwardness to assist him in the destruction of a people with whom they otherwise agreed in the most essential parts of their faith, as the Japanese had been informed by the Portuguese and Manilhese fathers, and to sacrifice to their own worldly interest those who followed Christ the very same way, and entered the kingdom of heaven through the same gate; expressions which I have often heard the natives make use of when the conversation happened to turn upon this subject. In short, our humble, complaisant, and obliging conduct notwithstanding, we were so far from bringing this proud and jealous nation to any greater confidence, or more intimate friendship, that, on the contrary, their jealousy and mistrust seemed to increase in proportion to the many convincing proofs of sincerity and faithfulness we gave them; and that the better we deserved of them, the more they seemed to hate and despise us, till at last, in the year 1641, soon after the total expulsion of the Portuguese, orders were sent us to quit our old factory at Firando, to exchange the protection of a good and indulgent prince for the severe and strict government of Nagasaki, and under a very narrow inspection to confine ourselves within that small island, I should rather say prison, which was built for the Portuguese." In this island or prison, 600 feet long by 240 broad, the Dutch continue to carry on their trade, where they are guarded like thieves or pirates, and placed under the most degrading restrictions. Kæmpfer gives a minute account of the guards that are placed over them, of the vigilance with which they are watched, of the daily musters that are made to see that none is amissing, of the extraordinary precautions employed to prevent the introduction of contraband goods, and of the sure penalty of death that follows the violation of the law. He gives an account of the punishment of two men, Japanese, who were detected with camphor concealed about their persons, which they had purchased from the Dutch, and who for this crime had their heads struck off by the common executioner; a deputy from the Dutch establishment being expected to attend at the execution, and to witness, for the instruction of himself and his companions, this wholesome example of severity. On one occasion, also, he relates that a Dutch sailor had thrown himself over board, and that when he did not appear at the daily muster the Japanese were all in despair, being terrified that it might be a Roman Catholic priest, and that he might have escaped into the country. "All the officers," he observes, "ran about scratching their heads, and behaving themselves as if they had lost their senses; and some of the soldiers in the guard-ships were already preparing to rip open their bellies, before superior orders could compel them to answer for their carelessness and neglect of their duty." It was not till the man's body was got up from the bottom of the sea that this alarm began to subside.

The moment the Dutch vessels are seen steering for the harbour by the spy-guards with their glasses, the system of vigilance begins. The ship is boarded by three persons from the Dutch factory, and the public interpreter, and the deputies from the governor, demand forthwith the list of the cargo and crew, also the letters on board, which are carried to Nagasaki, where they are examined by the governors. On entering the harbour, two guard-boats, with a number of soldiers on board, are placed on each side of her, and continued in their position, the guards being regularly changed till her departure. All arms, namely, guns, cutlasses, swords, and also the ship's stock of gunpowder, are given into the custody of the proper officers. The persons and trunks of the sailors are all searched with the utmost strictness, also every corner of the vessel; and the different packages are rigidly examined. All the approaches to the island in which the Dutch are settled are strictly guarded, both day and night, by officers appointed for the purpose. There is a company or corporation of interpreters, amounting to one hundred and sixty, who also do the duty of spies; and during the time of the annual sale the vigilance of all these functionaries is redoubled. Those who come to trade with the Dutch must submit to a strict search of their persons before they are admitted within the gates leading to their residence. No letters can either be sent or received unless they are previously entered in a register book, and a copy left with the governors.

The Chinese, who are admitted to trade along with the Dutch, are subjected to similar restrictions. They formerly carried on a free intercourse with Japan; but it was intimated to the Japanese that the Jesuits, after their expulsion from the country, had experienced a most friendly reception in China, and it was discovered that several of their books had been brought over by the Chinese and privately sold. This, together with the vast influx of the Chinese into Japan, raised the jealousy of the emperor and the court, and the Chinese were finally laid under the same restraints as the Dutch.

The goods chiefly imported into Japan are raw silk from China, all sorts of silk and woollen stuffs, coarse cotton stuffs, woollen cloth from Europe, hides raw and tanned, sugar, coffee, spices of all kinds, quicksilver, cinnabar, saffron, lead, saltpetre, borax, musk, gums, coral, amber, various articles of glass, and iron, lead, tin. The returns are chiefly made in copper, and along with it camphor, lackered ware, painted paper, and other articles of comparatively little moment. The trade of the Dutch and the Chinese with Japan was formerly very extensive. From the year 1611 to the year 1671 the speculations of the former were unrestricted, and their profits were enormous. According to the account of Kæmpfer, the Dutch gradually fell into discredit with the Japanese; their commerce was curtailed, they were subjected to ignominious treatment, their profits were diminished, and the trade is now confined to two annual ships, which sail from the port of Batavia. The Chinese send annually ten junks to the port of Nagasaki, the only port which is open to foreigners.

In 1814, when the island of Java was in possession of the British, Sir Stamford Raffles, the governor, distinguished on all occasions by his enlightened zeal for the interests of science and of social improvement, was deeply impressed with the importance of opening a commercial intercourse with the Japanese, and of acquiring for Britain a participation in the trade hitherto monopolised by the Dutch. The Japanese islands, containing, according to his estimate, about twenty-five millions of inhabitants, who require woollens, hardware, iron manufactures, and glass, besides many other articles, might, he justly conceived, afford a very extensive market for British goods. With this view, when the time arrived for the annual visit of the Dutch to Japan, he joined two other gentlemen in the mission, one of whom was Dr Ainslie, for the purpose of obtaining accurate information respecting the Japanese, and the Dutch establishment in Japan. He confirms all the previous accounts that had been received of the narrow and exclusive policy of the government, in consequence of which few op-

Japanning. portunities were afforded of a free communication with the natives. The commissioners, however, who were sent to Japan by Sir Stamford Raffles, state that the character of the Japanese had been greatly misrepresented by the Dutch for their own selfish purposes, and through fear of being interfered with by any other of the European states. So far from being a bigoted and intolerant race, as they are represented, they appeared to be remarkable for frankness of manner and disposition, for intelligence and the spirit of inquiry; and, in regard to religion or superstitious prejudices, to be perfectly inoffensive. The British commissioners were strongly of opinion that the commercial restrictions did not so much arise from the limitations or from the laws of the Japanese, as from the constitution of the Dutch factory. It is the interest of the resident and other functionaries to narrow the trade, that they may secure a larger profit for themselves; and, living at a distance from control, with a limited salary, they are compelled to scramble for every petty advantage to themselves, to the neglect of the general interests and prosperity of trade. From the degraded state of the Dutch factory, and the corruptions which prevail, the national character of this commercial people is lowered in the eyes of the Japanese, at whose hands they endure every species of humiliation. They prostrate themselves not only to the emperor, but also to the inferior chiefs, for which they are despised by the Japanese, as well as for all the other mean compliances which they submit to, rather than run the risk of sacrificing the trade. It was indeed intimated by the Japanese interpreters to Dr Ainslie, that the Dutch were the secret instigators of the massacre of the Christians at Simabara, and it is certain that they lent their active aid in that bloody transaction. The English commissioners were most courteously received in Japan; the people evinced the most earnest desire to communicate with them; their presents were even graciously received by the emperor; and, from this auspicious commencement, the most favourable hopes were entertained of a closer and more friendly intercourse with this singular people. But the surrender of Java to the Dutch put an end to all these expectations of extended trade; and the intercourse with Japan has since been continued on its former footing, all competitors having been, as heretofore, rigidly excluded.

Various attempts have been made by the Russians to open an intercourse with these islands, from their establishments along the eastern coast of Asia. But all friendly overtures with a view to a commercial intercourse have been decidedly rejected. In 1792 a deputation arrived from Japan at Okhotzk, requesting the aid of the Russians to extricate some unfortunate Japanese who had been thrown upon the desolate island of Oonalaska. The Russians were extremely ready in lending their aid in the cause of humanity, and the Japanese expressed the utmost gratitude for the services which they rendered them. The opportunity was deemed favourable for renewing the offer of commercial intercourse, and Captain Laxmann was sent, by orders of the empress, to that part of the coast of Jesso or Matsmai which is occupied by the Japanese. He was kindly received, and loaded with presents; but all commercial intercourse was steadily rejected. In 1814 Count Krensenstern, despatched to Japan on a similar errand, met with no better success. He was peremptorily told, by orders of the emperor, that his subjects traded only with the Dutch and the Chinese; and from the moment that he and his attendants arrived, they were exposed, as has already been related, to every possible ignominy, through the influence of the Dutch factory, jealous of competition; and they were finally requested to return to their own country, as they valued their lives, and never to come back. Since this time Captain Golownin, who was enticed on shore and detained in a severe captivity by the Japanese, reports that they are extremely jealous of the ascendency both of the Russians and of the English in the East, from the establishments of the Russians along the northern, and of the English along the southern coasts of Asia. These jealousies, there is every reason to suppose, are fostered by the Dutch, who alone have access to the Japanese, and who have even persuaded them that the Europeans are intent on adding Japan to the other extensive conquests which they have acquired in the East. At present, therefore, there is no prospect of any change in the exclusive policy of this singular people. They are even more rigid in their maxims of exclusion than the Chinese, who, through the free port of Canton, trade indiscriminately with all nations. But the Japanese confine the privilege of commerce to one port and to two nations, who either cannot or do not find it their interest to supply them with foreign produce to the extent which would be required if the existing restrictions were abolished. The cession of Java to the Dutch at the peace of 1814 is deeply to be regretted on this account, that it closed the door against all further communication of the British with Japan, and for ever frustrated the judicious and enlightened plans of Sir Stamford Raffles for promoting a free intercourse and a more extended trade with these islands. (F.)

JAPANNING, the art of varnishing and drawing figures on wood, after the manner of the Japanese, from whom it takes its name. The substances which admit of being japanned are almost every kind that are dry and rigid, or not too flexible; as wood, metals, leather, and prepared paper. The practice of japanning goods has varied from time to time. The following are some of the methods practised at present.

Japanning of cast and sheet iron black. Mix up some vegetable black with naphtha or spirit of turpentine, and let it sour for a night; then add as much japan as will not take away the body of the black. After the article has been freed from rust, coat it with this, and put it into the stove. When dry, let it be coated with japan; two coats are sufficient if the japan be rich or old. If the article is intended to be polished, another coat or two may be given, according to the surface of the article; and let it be gently cooled between each coat.

Polishing. To polish the above, take a piece of close-grained pumice-stone, ground down to a smooth and perfectly level surface, and with this slightly rub down all the knots. When this is effected, put the article into the stove till the parts which have been rubbed are hardened. Then take a piece of woollen cloth, stuffed with something of the same description, to the size of a small hand mallet, which japanners call a polishing bob; wet it through with water, then dip it amongst pumice-stone which has been sifted through muslin, and rub the whole surface till it is smooth. Sponge it clean with water when dry. The surface is then made perfectly smooth and fine by being rubbed with a piece of cloth similar to that just mentioned, and ground rotten-stone moistened with water. It is then wiped clean with soft silk; and, when dry, hard powdered rotten-stone is rubbed upon it with the points of the fingers, lengthways, when it receives a beautiful gloss. To preserve the lustre, sprinkle a small quantity of sweet oil and water over the whole, then smartly with both hands clean off the oil and water. This will produce a permanent and brilliant glossy black. If the cast or sheet iron is not ground, there is no use for the first coat of black, as the same coats of japan answer the purpose perfectly well.

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In japanning tin, care must be taken to deprive the article of any rosin or grease. It then receives one coat of black and two coats of japan, as in the case of cast or sheet iron. If it has to be polished previously to being coated, it is rubbed smooth lengthways with a piece of wool-comber's card, or coarse sand-paper. This will greatly aid the polisher, and in some instances may save a coat of japan. The article is then polished and oiled as before described.

Clean the tin as before mentioned, and give it one coat of japan. Let it then be put into the stove, and when dry give it another. If a dark brown is required, it is subjected to a strong heat; and if a light brown, a coating and a gentle heat only is necessary. Care must be taken that each coat is well settled or stiffened in the air, by turning it upside down to keep it from flowing all one way, before putting it in the stove.

Grind some Venetian red in spirit of turpentine very fine, to which add three parts of mixing varnish with one part of japan, that is, as much as will not take away the body of the red. Coat the article, and put it into the stove till it dry. Then give it one coat of japan pretty fluid, and let it settle in the air, as mentioned above. Put it again into the stove, and when dry it will appear of a fine brown colour. All metals may be japanned in this way, especially old tin ware. If a polish is required, use common vermilion instead of Venetian red, as it will require more coats. Another brown, commonly called chocolate, may be produced by using purple brown in the same way.

In japanning wood in the same way as metal, it ought to be dried or seasoned well in the stove before coating. A black is obtained by using the same black as that already mentioned. After the article has been dried in the stove and taken out, it is coated with japan; and this is repeated until the surface becomes smooth. Care must be taken not to let the article cool between the periods of each successive application of the japan, else the air may insinuate itself into the pores of the wood, and cause it to blister when put into the stove again. The article made or turned must be in one piece.

In japanning table tops, the best Spanish mahogany, plained and smoothed with sand-paper, must be used. First put it in the stove between two plates of iron, with a sufficient weight on it to keep it from casting or warping, till it be properly seasoned. Take it out and coat it with black as above mentioned. Afterwards put it into the stove to dry. Then coat it with japan until it has a flowing appearance. Should it blister between the coatings, rub the blisters down with fine sand or glass-paper. After the last coat has been applied, allow it to become perfectly hardened, and then polish it in the same way as metal is polished. This method is not generally known or practised, a prejudice existing that it will not stand the heat; but Spanish mahogany, three fourths of an inch thick, will stand the same heat as tin.

Small fire-screens made of plain-tree and other kinds of wood may be japanned in the same manner; but as they are done on both sides, it requires a frame made of tin, tapered inwards, so that the screen may rest gently on the edges of it. Flat articles, which cannot stand the necessary temperature, are japanned in the following manner. Grind fine some ivory-black with turpentine, then add two parts of japan and two parts of drying copal varnish; and after the wood has been well dried, coat it over three times. When it is dry, smooth it down with wet rag and ground pumice-stone. The smoothing being finished, take extra quick copal varnish, tinged with ivory-black, and give the article two coats. When these are hardened it may be polished. If great care be taken in laying on the varnish, polishing may not be necessary.

Coloured grounds on wood. White.

To a white lead ground in turpentine add one part of drying copal varnish, and mix them together. Coat the wood till the pores be filled up, and then rub it down as before described. Then take flake-white ground in turpentine, and add to it three parts of fine dial varnish; strain it through fine muslin, and let it stand for five or six hours; after which, coat the wood over twice, and let the first coat be properly hard before the other is applied. When sufficiently hardened, take a piece of fine flannel dipped in rotten-stone ground in water, and rub it till smooth, when it is rendered fit for working on. But if it is to be finished in the white, let it be rubbed all over with a mixture of sweet oil and flour, and then dusted with dry flour, which is afterwards wiped clean off with both hands, leaving a fine glossy surface.

Yellow.

The yellow ground may be filled up in the same way as the above with the lead. When it is filled up, take chrome-yellow ground in turpentine, and add three parts of fine drying copal varnish; strain this, and coat the article with it, as in the above case, and varnish and polish it in a similar manner.

Red.

Take common vermilion ground in turpentine, to which add one part of quick-mixing varnish. Fill up the ground with this, and then take Chinese vermilion ground in fine drying oil, thick, adding to it a small quantity of fine mixing varnish, to make it free in working. With this preparation the article is twice thinly coated, which method is preferable to laying on only one thick coat. When dry, it will be fit for working on. But if it is intended to be polished, give it two coats of fine quick-polishing varnish, and let the first coat be very hard before it receives the second. After it is properly hardened, take a woollen rag dipped in ground pumice-stone and water, and rub the ground all over. When it is smooth, take a flannel rag dipped in ground rotten-stone, and finish it, as in the case of the white.

Blue.

Fill up the blue ground in the same manner as the white is filled up; and a little Prussian blue may be added to it. When filled up, Prussian blue and white lead are ground by themselves upon the same stone, and afterwards mixed together in proportions varying according to the shade required. The after-process for polishing is the same as that already described.

Green.

Fill the green ground as in the case of the white, adding lamp-black to make it of a lead colour, the quantity employed being in proportion to the shade required. When filled up and smoothed, take emerald-green ground in turpentine, and add a small quantity of mixing varnish to it, so that the green may be flat, for it will require three coats, as the green has a very little body. It is then smoothed and rendered fit for working on. If a dark hue is wanted, take Brunswick green, which may be made lighter by adding a little chrome-yellow; or darker, by adding Prussian blue and black. This green is more easily produced than any other. Varnish and polish the article as before described.

Purple.

Take white lead ground in turpentine, and add crimson-lake and Prussian blue, according to the shade wanted. The article is then coated, varnished, and polished, in the same way as the red. All the above grounds may be enriched by giving each a coat of thin primitive colours ground in turpentine, and mixed up with fine clear mixing varnish. These are crimson-lake for red, yellow-lake for yellow, Prussian blue for blue, verdigris for green, and lake and blue for purple.

To produce damask grounds for white, when the ground is fit for working on, take fine dial varnish for size, so that it may not discolour the ground, and size the device. Let it stand till it slightly attaches itself to the finger; then take a piece of shamoy leather, dip it in silver powder, and shade the device with it, when it will appear like damask.

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Red and crimson damask.

For obtaining red or crimson, after the ground has been smoothed with the common vermilion, take japanners' gold size, thin, and size the device; when it adheres to the finger, take orange-bronze and shade it as above. This being dry, coat it with crimson-lake ground in turpentine and mixed with fine polishing varnish; polish it as usual, and a rich damask ground will appear.

Yellow damask.

This ground must be a very light yellow. Use size and silver powder, the same as in the case of the white; coat it with yellow-lake ground in turpentine and mixed with polishing varnish; coating, varnishing, and polishing it as usual.

Blue.

Make the ground a very light blue, almost approaching to white; use the size and silver as in the above case; take Prussian blue ground in turpentine and mixed with polishing varnish, and coat it to the shade required, then varnish and polish it as usual.

Green.

Make a light bluish-green with verdigris and white lead ground, use size and silver as in the case of the white, then take verdigris ground in terpentine, and mix it with slow-drying varnish, to prevent it from cracking, as the verdigris is very brittle; coat it to the shade wanted, and varnish and polish it as usual.

Purple.

Make a ground of crimson lake and Prussian blue mixed with white lead, very light; then take lake and blue ground in turpentine and mixed with polishing varnish; coat it to the shade required, size and silver it as in the case of white, and varnish and polish it as usual.

Beautiful grounds are produced with the silver powder; and devices on black grounds with either of the above colours, which greatly enrich the appearance of the deep or pale gold ornaments that are wrought upon then.

All the above coloured grounds may be produced on metals in the same way, with the exception of the white. In filling up metals, take Venetian red ground in turpentine or tar spirits, add as much japan as will give it body enough, so as not to crack, and afterwards coat the article till it is filled up; then smooth it down with lump pumice-stone. Put it into the stove till dry every time it is coated, then lay on the ground colour as before mentioned.

With regard to sizing and gilding on japan grounds, take the gloss off the part that is to be worked on, by which means the size will be better seen. In ornamenting any article, as, for instance, a tea-tray, with various golds, bronze, and colour, proceed thus: After tracing or drawing out the ornaments, size the parts for your deep gold first, and then gild them, the parts for the pale gold being also gilt; and care must be taken that the size has but a slight adhesive feel before the gold is put on. If bronze shaded is introduced, size the part first, and then take a hair pencil and dip it into the bronze or gold powder gently; then rub the sized part, and it will produce a soft shade. If it is to be solid bronze, let it be nearly dry; rub the sized part gently over with a piece of shamoy leather dipped in bronze, then warm the tray, and rub the part over smartly, when it will appear solid with a metallic lustre. After all is gilt and bronzed, take a common pen and etch up all the finer parts of the ornament with it; but for the stronger parts take a fine camel-hair pencil dipped in black, to open up the ornament. The gold may be shaded with terre senna, and then put into the stove till dry, when it may be varnished and polished in the usual way.

In putting on raised work, take Chinese vermilion two parts, and white lead two parts; mix them thick together with turpentine, adding a small quantity of japan so as to make it adhere to the ground. Then take a long hair pencil and dip it amongst the raising, keeping the pencil upright so as to feed the point. Although the raising appear flat or dull, it will take a bright polish by rubbing it with the finger, after which it is sized and gilt.

Japetus || Japheth.

In imitating Japanese or Chinese, this must be done on gloss or polished ground. As this kind of work is not varnished, a little oil-colour may be mixed with the gold size, such as white lead or chrome-yellow, which will enable the fine lines to be better seen, and make the work more closely resemble gilding.

In painting on japan work, either oil or varnish colour may be used. The varnish colour looks clearest, and is most showy, but it requires great practice to blend the colours so as to appear soft; oil-colour is at present that most frequently used.

In varnishing white wood-work, or work covered with paper, take sheep-skin size in a liquid state, dip into it a camel-hair flat brush, and come over the work swiftly with it, so as not to wash up the painting. When this is dry, take hard white spirit varnish and a camel-hair flat brush, and coat the work over smartly. It will appear whitish at first, but it will become clear as it dries. After it has received four coats, let it stand for a day, until small cracks appear all over it. Rub the gloss off the work, or any knots, with the dry fingers, and then wipe it clean; after which give three or four coats more, when the varnish will appear full and flowing. Allow it to stand for a day or two, then take a piece of woollen cloth wet with water, dip it in ground pumice-stone, and smooth down the work with it, and then wipe it clean. After this take a piece of woollen cloth and dip it in rotten-stone ground in sweet oil, with which rub the work till a gloss appears. After wiping it, dip a piece of fine flannel in sweet oil mixed with flour, and rub the work smartly; powder it with dry flour, then rub it quickly off with the palms of the hands, and a brilliant gloss will appear.

In japanning paper after it comes out of the dip-stove, it must be coated till a full flowing body of japan is produced. In polishing the above, care must be taken that the ground is not overheated in the rubbing. If it be brought up with amber varnish, it must stand till it be thoroughly cool, otherwise the attraction of the ground will draw the size out of the pencil before the work can be executed. As black japan is generally the colour that paper-grounds are filled up with, it greatly depends on the japan or varnish being rich or old, as either will produce a good gloss to the number of coats given. For any other colour that is required, rub down the above ground smooth; for the first coat let it be white, but tinged a little with the colour wanted, unless it be marone. The first coat must be a light-olive colour smoothed down, thinly coated with crimson lake; if a dark marone, purple-lake is the pigment employed. The best polishing varnish ought to be used in the finishing. Paper trays are brought up in boards, sheet above sheet, with paste, to the thickness required, with the exception of the edges, which are done upon iron moulds, and then taken off, planed, glued, and nailed together, like a piece of wood. With regard to Bristol board, or any other paper, it is japanned in the usual manner, with a first coat of sheep-skin size to make it bear out.

JAPETUS, a son of Cœlus and Terra, who married Asia, Asope, Theonis, or Clymene, and had four sons, Atlas, Menœtius, Prometheus, and Epimetheus. He was thus considered as the author of the Hellenic race. (Apollodor. i. 1, 2; Diodor. v. 66, 67; Hesiod, *Theog.* 134. Iapetionides, a son of Japetus; Atlas, Ovid. *Met.* iv. 631). He is supposed to be the same as Japheth, the son of Noah.

JAPHETH, the son of Noah. His descendants possessed all Europe and the islands in the Mediterranean, as well those which belong to Europe, as those which depend on Asia. They had all Asia Minor, and the northern parts of Asia above the sources of the Tigris and Euphrates. Noah, when he blessed Japheth, said to him, "God shall enlarge Japheth, and he shall dwell in the tents of Shem; and Canaan shall be his servant." This blessing of Noah is supposed to have been accomplished when the Greeks, and after them the Romans, carried their conquests into Asia and Africa, where were the dwellings and dominions of Shem and Canaan.

JAPYDES, or IAPODES, a people who stretched along the coast of the Adriatic, from the Gulf of Quarnero, as far as *Zara*, the ancient Jadera, for a distance of 1000 stadia. They occupied the valleys of Mons Albius, which form the extreme point of the Alps to the east, extending in the interior to the Pannonii and the Ister or Danube. They were finally subdued by Augustus after they had twice defeated the Romans within twenty years, attacked Aquileia, and plundered Tergestum or Trieste. Their towns were Metulum, Arupenum, Monettium, and Veudum. They were in the habit of tatooing their bodies. (Strab. vii. 315; Appian. *Illyr.* 18, 19.)

JAQUELOT, ISAAC, a learned French Protestant divine, was born on the 16th December 1647, at Vassy in Champagne, of which place his father was minister. The revocation of the edict of Nantes having obliged him to quit France, he took refuge first at Heidelberg, and then at the Hague, where he procured an appointment in the Walloon church. Here he continued till that capital was taken by the king of Prussia, who, having heard him preach, appointed him his French minister in ordinary at Berlin, to which city he removed in 1702. During his residence at Berlin he entered into a warm controversy with M. Bayle on the doctrine advanced by him in his dictionary concerning Manichæism, which dispute continued until death imposed silence on both parties. It was in this controversy that M. Jaquelot openly declared in favour of the Remonstrants. His reputation as a writer rests principally on the following works, viz. 1. Dissertation sur l'Existence de Dieu, Hague, 1697, in 4to; 2. Dissertation sur la Messe, où l'on prouve aux Juifs que Jésus-Christ est le Messie promis, et prédit dans l'Ancien Testament, Hague, 1699, in 8vo; 3. Traité de la Vérité et de l'Inspiration des Livres du Vieux et du Nouveau Testament, Rotterdam, 1715, in 8vo; 4. Select Sermons, Geneva, 1721, in two vols. 12mo.

JAR, an earthen pot or pitcher, with a big belly and two handles. The word comes from the Spanish *jarra* or *jarro*, which signifies the same thing.

JARCHI, SOLOMON, otherwise *Isaaki Solomon*, a famous rabbi, born at Troyes, in Champagne, who flourished in the twelfth century. He was a perfect master of the Talmud and Gemara; and he filled the postils of the Bible with so many Talmudical reveries, as totally extinguished both the literal and the moral sense of it. The greater part of his commentaries are printed in Hebrew, and some have been translated into Latin by the Christians. They are generally esteemed by the Jews, who have bestowed on the author the title of *prince of commentators.*

JARDYN, or JARDIN, KAREL DU, a painter of conversations, landscapes, and such like subjects, was born at Amsterdam in 1640, and became a disciple of Nicholas Berchem. This painter, in colouring and touch, resembled his master Berchem; but he added to that manner a force which distinguishes the great masters of Italy; and it is observed, that most of his pictures seem to express the warmth of the sun, and the light of mid day. However, some of his subjects are often more extensive, containing a greater number of objects, and a larger design. His works are as much sought after as they are difficult to be met with. He died at the age of thirty-eight.

JARENSK, a town of the Russian province of Wologda, the capital of a circle of its own name, extending over 23,936 square miles, but containing no more than 31,500 inhabitants. It is generally a neglected district, covered with woods, marshes, and lakes. The town is situated on the river Wytscheda, which is usually closed by frost from the beginning of November to the middle of April. It contains 200 houses, and from 1000 to 1100 inhabitants. Long. 47. 33. E. Lat. 61. 20. N.

JARGEAU, a town of the arrondissement of Orleans, in the department of the Loiret, in France. It stands on the left bank of the river Loire, over which is a fine bridge. It contains 428 houses, and 2690 inhabitants. Long. 2. 1. E. Lat. 47. 50. N.

JARMERITZ, a town of the circle of Znaym, in the Austrian province of Moravia, and situated on the river Rokitna. It has near it a magnificent palace and park belonging to the family of Questenburg, with a very extensive library. The town contains 272 houses, with 1650 inhabitants.

JARNAC, a town of the arrondissement of Cognac, in the department of the Charente, in France, on the right bank of the river. It contains 1560 inhabitants, amongst whom are merchants dealing very extensively in brandy for foreign countries. It is celebrated for the great battle fought there in 1569, between the Huguenots and the Catholics, in which the Prince of Condé was taken prisoner.

JAROSLAW, a government of European Russia, formerly in the province of Moscow, to the eastward of Twer, extending over 15,202 square miles. It comprehends twelve cities or towns, 554 parishes, 7705 villages, and 1,022,900 inhabitants. It is an elevated level district. The soil is generally marshy, but mixed with portions of sandy or clayey land. It is miserably cultivated, and though all the population are chiefly occupied in agriculture, it scarcely produces sufficient corn (chiefly rye and barley) for their subsistence. Both hemp and flax succeed tolerably well; and the conversion of these into the various kinds of linen is a means of affording to the inhabitants of the towns occupation and subsistence. The hides of their cattle also form a branch of employment to the people, as does the fishery on the rivers and lakes. The river Wolga enters the province from Twer, and receives the waters of numerous streams that flow through it. There is a lake of eight miles in length and three in breadth, called Rostow, out of which the Kotorosla runs to the Wolga; and thirty-six smaller lakes, all, like the streams, abounding in fish. The Wolga is navigable in its whole progress through the province, as are also the Mologa and the Scheksna, which run into it. The province is divided into ten circles. The capital, Jaroslaw, is also that of the circle of the same name. It stands at the junction of the Kotorosla with the Wolga. It has no other fortification than palisades, but is defended by a fortress. It contains forty-four churches, several convents and hospitals, 2754 houses, and 24,200 inhabitants, whose chief subsistence arises from the linen trade, and Russia leather. Long. 30. 4. 55. E. Lat. 57. 57. 30. N.

JAROSLAW, a city in the circle of Przemysl, in the Austrian kingdom of Gallicia, and situated on the river San. It contains a minster and six other churches, for Catholics, Greeks, and Protestants, with 1400 houses, and 6975 inhabitants, occupied in linen and woollen manufactures, and in distilleries. It was a part of the ancient kingdom of Poland, and is still the property of Prince Adam Czartoryski, a nobleman of the country. Long. 22. 47. E. Lat. 49. 59. N.

JASHER, THE BOOK OF. This book is mentioned by Joshua, and referred to in the following passage: "And the sun stood still, and the moon stayed, until the people had avenged themselves upon their enemies: is not this written in the book of Jasher?" It is difficult to determine what this *book of Jasher*, or "the upright," is. St Jerome and the Jews believed it to be Genesis, or some other book of the Pentateuch, in which God had foretold that he would do wonderful things in favour of his people. Huetius supposes it to have been a book of morality, in which it was said that God would subvert the course of nature in favour of those who put their trust in him. Others pretend that it was public annals, or records, which were styled *just*, or *upright*, because they contained a faithful account of the history of the Israelites. Grotius believes that this book was nothing else than a song, composed to celebrate the miracle, and victory therewith connected. This seems the more probable opinion, because the words cited by Joshua as taken from the work, "Sun, stand thou still upon Gibeon, and thou moon in the valley of Ajalon," are such poetical expressions as do not accord with historical memoirs; besides that, in the second book of Samuel (i. 18), mention is made of a book under the same title, on account of a song composed on the death of Saul and Jonathan.

JASLO, a circle of the Austrian kingdom of Gallicia, extending over 1354 square miles. It contains five cities, eleven market-towns, and 366 villages, inhabited by 195,200 individuals, occupying 28,562 houses. It consists of part of the Carpathian Mountains, and the soil is for the most part poor and stony; but it produces corn equal, with the aid of potatoes, to the consumption. The capital is the city of the same name, situated at the junction of the rivers Jastel and Wisloka, and containing 224 houses, and 1463 inhabitants.

JASON, chief of the Argonautic expedition, was son of Æson, king of Iolcos, and of Alcimede or Polymede. His father was obliged to yield to the superior power of his brother Pelias, and was driven from his kingdom. Jason was secretly carried by his mother to the valleys of Mount Pelion, and there delivered into the hands of Chiron the centaur. By him he was trained to the arts of war, and began his adventurous career by joining in pursuit of the Calydonian boar. Then, in obedience to the orders of an oracle in Magnesia, he presented himself at Iolcos to reclaim the kingdom, covered with the skin of a leopard, and armed with two javelins. Pelias had been warned by an oracle to beware of a man who should appear with one foot shod and the other uncovered. Jason, by some accident, entered Iolcos in this manner, and the suspicions of Pelias were of course immediately excited. He boldly demanded the kingdom, to which he was the rightful heir; but Pelias prevailed on him to proceed to Colchis to get possession of the golden fleece, promising on his return to resign the crown. He was accompanied in this expedition by all the bravest of the Greeks (see Argonauts); and, after many curious adventures, they all arrived in safety in Colchis. Jason proceeded to present himself at the court of Æetes, and explained to him the object of his voyage. The king agreed to restore the golden fleece, provided he submitted to certain conditions the former would impose on him. He must tame brazen-footed bulls, whose nostrils breathed flames, and plough with them a field sacred to Mars. He must then kill a dragon which kept watch day and night over the golden fleece, and sow in the field which he had tilled the teeth of this serpent, from which armed men would spring, ready to attack him. The destruction of Jason seemed inevitable, but he was extricated from his difficulties by Medea, the king's daughter. His lofty bearing, and the intrepid nature of the enterprise, had captivated the heart of Medea, and she determined to deliver her lover from all his dangers, if he promised her eternal fidelity. By her magic herbs, he performed the conditions, to the astonishment of Æetes and his subjects; and, having obtained possession of the golden fleece, returned to his native country, accompanied by Medea, whom he afterwards married. Medea, however, carried along with her Absyrtus, her brother; and when she heard that her father was in pursuit, she tore him to pieces, and scattered his limbs in different places, that she might escape whilst her father was employed in collecting the mangled body of his son. They arrived in safety in Iolcos, where they were received with the greatest joy. Æson was restored to youth again by the magic power of Medea; and Pelias, the usurper of the crown, wishing to be restored to the flower of youth, allowed himself to be cut up by his daughter at the persuasion of Medea, and thrown into a boiling caldron. Thus Pelias perished by a miserable death. But Jason was obliged to fly with Medea, and proceed to Corinth, where they lived in great harmony for four years. At the end of that time, having divorced Medea, he married Glauce, or Creusa, daughter of Creon, son of Sisyphus, king of Corinth; but his inconstancy was severely avenged. Medea slew his sons in his presence, and burnt Creusa, together with Creon and Jason. Another tradition states that they returned to Colchis, and reinstated on his throne Æetes, whom a faction had expelled.

JASPER, a species of mineral belonging to the siliceous genus of stones, and of which there are many varieties, some of them extremely beautiful, which are much sought after, and employed as trinkets and ornaments. See Mineralogy.

JASPONYX, an obsolete term in mineralogy, importing, as appears from the name, a compound of jasper and onyx.

JASSY, a city, the capital of Moldavia, the residence of the prince, of a Greek archbishop, and of many of the waywodes or nobles. It stands on a lofty situation, but is surrounded with hills still higher. It is watered by brooks forming a stream ending in the Pruth. The town is composed chiefly of wooden houses, and is said to be excessively filthy, and by no means healthy. The palace of the prince is plain, small, and badly situated. The city contains no less than forty-three churches, with twenty-six convents and nunneries of the Greek religion. It has also a Catholic and a Lutheran chapel. The houses are stated to be six thousand in number, and the inhabitants from twenty-five to thirty thousand. It is not a place of any other trade than such as arises from providing for the luxuries of a voluptuous nobility and a petty sovereign. Long. 27. 24. 55. E. Lat. 47. 8. 30. N.

JASTROW, a city of the circle of Deutschkrone, in the province of East Prussia, situated on a brook running to the river Kuddow. It contains 296 houses, and 2380 inhabitants, of whom more than 400 are Jews. There is a manufactory for arms and military clothing.

JAUER, a city, the capital of a district of the same name, in the circle of Herschberg, of the Prussian province of Silesia. It stands on the river Neisse, is surrounded with walls and ditches, and contains one Lutheran and five Catholic churches, 604 houses, and 5230 inhabitants, chiefly occupied in the several branches of the linen manufacture.

JAULNAY, a town of the arrondissement of Poitiers, in the department of the Vienne, in France, on the river Elain, with 245 houses and 1476 inhabitants. Close to this town was fought, in 1356, the battle usually called that of Poitiers, and sometimes Maupertuis, in which Edward the Black Prince defeated the French army, and made King John a prisoner.

JAUNDICE (derived from the French *jaunisse*, yellowness, of *jaune*, yellow), a disease consisting in a suffusion of the bile, and a rejection thereof to the surface of the body, whereby the whole exterior habit is discoloured.

JAUTS, a people of Hindustan, who have at different times made some figure in its annals. The first historical mention of them occurs at the beginning of the eleventh century, on the invasion of India by Mahmoud the Gaznevide. That conqueror found them established on the eastern bank of the Indus, prepared to oppose his passage. For this purpose they had mustered a large fleet of boats, to the number, according to some accounts, of eight thousand. They were completely defeated, however, and driven into the mountainous districts in the interior of India.

From this time the Jauts remained in obscurity, till the reign of Aurungzebe. Churamana, a Jaut of some distinction, collected then some troops of banditti, with whom he began to commit depredations on travellers. Popular and enterprising, he gradually rose from a captain of robbers to be a powerful chieftain; and, availing himself of Aurungzebe's absence in the Deccan, became the terror of the country round. He had even the audacity, on one occasion, to plunder the rear of that monarch's army; and, when pursued, took refuge among the mountains of Narwar, where he eluded all attempts to extirpate his force. Under the growing imbecility of Aurungzebe's successors, the Jauts continually extended their power, till at length, during the weak reign of Mahommed Shah, and under their enterprising head, Sooraje Mull, it rose to its utmost height. That chief wrested continually new concessions from the weak emperor, till he was able almost to dictate the counsels of the Mogul court. A reverse, however, took place on the invasion of Northern India by Ahmed Shah, the sovereign of Caubul. Sooraje Mull, having opposed that invader, saw his territory overrun, and was obliged to seek aid from the Mahratta power. When the Mahrattas, however, invaded Delhi, the Jaut chief went over to Ahmed Shah, and offered to atone for former hostility by his services on that critical occasion. The battle of Panniput followed, in which the Mahrattas were totally routed, and their power for the time entirely broken. Ahmed Shah rewarded the services rendered by his new ally in this hour of need, by the important cession of Agra and its district. Sooraje Mull, and his son Jowalier Sing, made repeated attempts to obtain possession of Delhi, but were always baffled by untoward circumstances. Jowalier Sing was assassinated by an impostor, who had undertaken to initiate him in the secret of the philosopher's stone. He left his son an infant; a circumstance which, affording an open field to the dissensions of the chiefs, weakened the Jaut power, and rendered it unable to contend with the other fierce competitors for the spoils of the Mogul. In their contests, particularly with Nujeeph Khan, they were gradually stripped of all their possessions, and at length reduced to the fortress of Bhurtpore, with a small surrounding district. When the British power became predominant in this part of India, Runjeet Sing, rajah of the Jauts, sought security by concluding a treaty with Lord Lake, by which, on engaging to assist Britain against all enemies, he not only retained the internal government of his territories, but was even exempted from paying any tribute. Yet, in 1805, after the defeat of Holkar, he received that chief, with his discomfited army, into Bhurtpore. The place sustained a most desperate siege, and cost the British army an immense number of lives. At length the rajah, despairing of effectual resistance, agreed to compel Holkar to quit the place, and to give it up to the British, on condition of retaining the government of his territories, and the fortress of Deeg. He was obliged, however, to pay twenty lacs of rupees, and to give ample security for a more faithful observance of this treaty than of the former.

JAVA.

This large and fertile island belongs to the group which modern geographers denominate the Sunda Islands. It extends eastward, with a slight deviation on the south, from 105. 11. to 114. 33. of east longitude from Greenwich, and lies between the latitudes of 5. 52. and 8. 46. south. It is in length, between Java Head and the south-east point of the island, 666 statute miles; and its breadth varies from 135½ miles, between the south-west point of Pachitan Bay and the north point of Japara, to fifty-six miles, between the mouth of the Serayu River and the Marabaya. Its area is estimated at 50,000 miles. On the south and west it is washed by the Indian Ocean; to the north-west by a strait called the Straits of Sunda, which separates it from the island of Sumatra at a distance, at the narrowest point, of only fourteen miles; and on the south-east by the Straits of Bali, only two miles wide, which divide it from the island of that name. These islands, and others stretching eastward, form with Java a gentle curve of more than 2000 geographical miles. From the eastern peninsula of India, Java is distant 140 leagues, from Borneo about fifty-six leagues, and from New Holland 200.

Aspect of the country.

The island of Java is of a rectangular form, so that if it were divided into five or six parts, each would form a parallelogram. It is extremely diversified on its surface. An uninterrupted range of lofty mountains, varying in elevation from 5000 to 11,000 and even 12,000 feet above the level of the sea, and exhibiting in their round bases or pointed tops their volcanic origin, extends almost east and west through the whole length of the island. They rise to their greatest elevations towards the centre, which is much broken. The tops of these mountains were formerly the craters of volcanoes, which are now extinguished, though many of them emit smoke after heavy rains. From this great chain other innumerable ranges of hills of inferior height run in various directions, and serve to form and confine plains and valleys of different elevations and extent. These mountainous regions present all the most romantic and highly diversified scenery which is to be found amid waving forests, never-failing streams, and constant verdure, heightened by a pure atmosphere, and the glowing tints of a tropical sun. The aspect of the northern coast is low, in many places swampy, and overgrown with mangrove trees and bushes, particularly towards the west. But in advancing five miles inland a sensible improvement is experienced in the atmosphere and climate. Every step in advance leads to a purer air and a brighter scene. Here, amid the mountains, are found elevated and fertile plains, the seat of industry and skilful cultivation. "Here," says Sir Stamford Raffles, "stupendous mountains are clothed with abundant harvests, impetuous cataracts tamed to the peasant's will. Here is perpetual verdure; here are tints of the brightest hue. In the hottest season the air retains its freshness, in the driest the innumerable rills and rivulets preserve much of their water. This the mountain farmer directs in endless conduits and canals, to irrigate the land, which he has laid out in terraces for its reception; it then descends to the plains, and spreads fertility wherever it flows, till at last, by numerous outlets, it discharges itself into the sea."[1] The principal harbour is that of Sourabaya, in the eastern districts, formed by the approaching extremities of Java and Madura, which is broad and spacious, and secure against the violence of the sea and the wind. The next in importance is that of Batavia, more properly the roads of Batavia, which

[1] See *History of Java*, by Sir Stamford Raffles, vol. i. p. 24.

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are sheltered by several islands lying in the outer part of the bay. There are other positions along the northern coast which might be improved into convenient harbours, though the whole coast affords excellent anchorage at moderate depths during nearly all seasons of the year. In the smooth sea and moderate weather which usually prevail, the native vessels and small craft always find sufficient shelter at the change of the monsoon, when it is dangerous to anchor on the coast, by running for shelter under some of the islands which are scattered in those seas, or passing up the rivers, which, though presenting a difficult entrance, from the mud banks, that form a bar at their mouth, are mostly navigable for small vessels as far up as the maritime capitals through which they run. The south coast, which rises into high and rugged cliffs, is inaccessible, with the exception of a few bays, on account of its exposure to the open sea, and the violent surf which in consequence dashes against it.

From the mountains of Java numerous streams pour down into the plains. There is no space, indeed, for the formation of large rivers. But there are probably no less than fifty which in the wet season bear down rafts of timber and other rough produce of the country, and not less than five or six at all times navigable to the distance of some miles from the coast; and those which are useful to the agriculturist for the irrigation of the lands cannot be numbered. The principal rivers are the Solo, the largest in the island, which discharges itself on the north side by two principal outlets into the sea near Gressek, and by which the produce of an extensive country is carried down in flat-bottomed boats to the sea. The river of Sourabaya, which is the second in magnitude, falls into the sea by five outlets near Sourabaya. There are several smaller rivers in these eastern districts, which fall into the ocean on the northern shore, and which are highly useful for the conveyance of teak timber from the interior forests to the coast; or which, being directed into canals, tend to improve the inland navigation of the country. Towards the west, the principal rivers which fall into the sea on the northern coast are the Chikandi, the Chidani, the Chitaram, and the Chimanok. Those which discharge themselves by the south coast are the Chimandiri, which falls into the sea at Wyn-Coop's Bay, the Chitandui, the Serayu, and others. Along the northern coast almost every district has its principal river, but they have all the disadvantage of being blocked up at their entrance by the accumulation of mud banks, an evil which is increasing with the extension of agriculture, from the quantity of soil necessarily washed down in the process of irrigating the land for the cultivation of rice. Java contains no lakes of any considerable size, though there are several very beautiful lakes of small dimensions among the hills, many of which are the craters of extinguished volcanoes. There are also extensive swamps, which, though they are filled with water during the wet season, are for the rest of the year dried up or choked by vegetation.

Soil and climate.

Java possesses a soil that is extremely rich, and remarkable for its depth, owing, as Sir Stamford Raffles conjectures, to the exclusively volcanic constitution of the country, and the quantity of new mould that is constantly washed down the sides of its mountains. The best soil resembles the richest garden mould in Europe. The seasons, as in all tropical countries, are distinguished into wet and dry, and depend on the periodical winds, or the monsoons. The west monsoon, which brings on the annual rains, begins in October, and becomes more steady in November and December; it continues till the latter end of February or the beginning of March. It often blows with great violence, and is accompanied with heavy rains, which renders this the most unhealthy season. The month of April ushers in the easterly winds and fair weather, which continue for the remaining half year. But the rains, though they often fall in torrents, are not so constant nor so violent as on the continent of India. During the rainy season there are days free from showers; while, again, in July and August, occasional rains refresh the atmosphere, and preserve the brightest verdure of the landscape throughout the year. Thunder-storms are frequent, and the lightning very vivid. The thermometer on the northern coast, at Batavia, Semarang, and Sourabaya, occasionally rises, about three in the afternoon, to 90°, which it rarely exceeds; but in general it has been found to range between 70° and 74° in the evenings, and 83° at noon, or at Semarang 87°. At thirty or forty miles inland from Batavia, on the mountains, it ranges between 60° and 70°, above which it seldom rises. On the hills of Semarang, where Europeans frequently reside during the dry season, at an elevation of about 4000 feet, it is frequently, in the mornings, as low as 45°, and ranges between 50° and 62°; and on the summit of one of the highest mountains, Sindoro, it has been seen as low as 27°.[1] From its insular situation, Java enjoys the benefit of the land and sea breeze; and its diversified surface affords the choice of climate, and a regular diminution of temperature, in proportion to the elevation. With the exception of the city of Batavia, where the climate is the most baneful in the world, and the low marshy flats on the northern shore, the island of Java is, in point of salubrity, equal to the healthiest parts of British India, or of any tropical country in the world. This fact is attested by the medical registers of the different British regiments stationed in this island. From the 1st November 1813 to the 1st November 1814, the deaths among 7470 British troops, who were exposed to many disadvantages and privations, did not exceed 504, which was only in the proportion of 1 to 14. From November 1814 to November 1815, out of 7487 troops, 252 died, 63 by fever, 123 by dysentery, and 65 by other diseases, which is only in the proportion of 1 in 30 in a year; a low estimate for climates that have borne a better character for salubrity than that of Java.

Vegetable produce.

This island abounds in the number and extraordinary variety of its vegetable productions. Between the tops of the mountains and the sea-shore is comprised almost every degree of temperature, and hence the produce of every region finds here some congenial spot. Rice, of which there are a hundred varieties, is cultivated on all the low grounds and ravines along the sea-coast, and in other situations commanding a supply of water. It is the great staple of agriculture in Java, to which every other species of husbandry is subordinate; and this island is the granary of the eastern archipelago, from which all the other adjacent islands and states of Sumatra, Molucca, Borneo, Celebes, and the Moluccas, have been long supplied; while every year about six or eight thousand tons were formerly sent by the Dutch to Ceylon, Coromandel, the Cape, and their other settlements. Notwithstanding this abundant produce, it is calculated that about seven eighths of the island are either neglected or badly cultivated; and such is the fertility of the soil, that it is from the remaining one eighth that these great supplies are derived. Maize or Indian corn ranks next in importance to rice, and is principally cultivated in the higher regions, and in those tracts where there are no mountain streams for the irrigation of the soil. Its cultivation has of late been extended in Java, and is becoming more and more a favourite article of food. Wheat has been introduced by the Europeans, and cul-

[1] See Raffles' *History of Java*, vol. i. p. 36; *Batavian Transactions*, vol. viii. Introductory Discourse.

tivated with success to an extent required by the European inhabitants. It thrives well in the interior of the country. Oats and other grain thrive in those parts of the island, and would be produced in great abundance were due attention given to their culture. Potatoes have been cultivated during the last forty years, in elevated situations, near all the principal European establishments, and are found of a good quality; also most of the common culinary vegetables of Europe, though their quality is apt to degenerate unless fresh supplies of seed be procured from Europe. Other species of grain, and leguminous vegetables, and a variety of pulses, are raised as green crops in intervals between those of rice; and in times of scarcity the natives make use of various kinds of the plantain, also the yam and the sweet potato. But in general Indian corn is the only article used by some as a substitute for rice. Cotton of an inferior quality to the Indian cotton is cultivated in almost every part of the island, and its cheapness occasions a considerable exportation. The coffee plant thrives luxuriantly in Java. It was first introduced about the year 1723 by the Dutch, who established a monopoly of the article, and forced the natives to cultivate it, and deliver it into the government stores at a reduced price. During the French administration of Marshal Daendels this cruel oppression was carried still further, and in certain districts every family was forced to take care of a thousand plants, and deliver the produce into the government stores. Under the more humane rule of the British governor, Sir Stamford Raffles, the free cultivation of coffee was permitted to the inhabitants, and all compulsory labour was abolished. The quality of the Java coffee is reckoned superior to that of the West Indies, and ranks with that of Bourbon in the European markets; its cultivation, for which many parts of the island are eminently adapted, has therefore been greatly extended; and it is exported to the amount of twenty-six millions of pounds, which is about two sevenths of the produce of the West Indies. The soil is very favourable to the growth of tobacco, which was introduced by Europeans, and is now extensively raised for exportation in the central districts of the island, about five millions of pounds being sent to the rest of the archipelago. In some parts it forms, after rice, the most important article of cultivation. Pepper was at one time the principal export from Java; but it was strictly monopolized by the government, and the most oppressive modes were resorted to in order to enhance its price. For some time past it has ceased to be cultivated to any extent. Indigo is raised in most parts of the island; and both the climate and soil of Java offer peculiar advantages for the extensive cultivation of this plant. The natives prepare the indigo very unskilfully, and hence it is of very indifferent quality. But if it were more carefully manufactured, it might form a most valuable and important export for the European market.

Notwithstanding the extent to which cultivation has been carried in many districts of the island, large portions of the surface are covered with primeval forests, affording excellent timber for almost every purpose. Extensive forests of teak are found in almost all the eastern provinces, but especially in the central districts of the island. There are great varieties of other kinds of timber, as the *suren* (the *tuna* of Bengal), of which the wood is light, strong, and durable, having something of the smell of cedar, and which, as the grain is not fine, is used for making chests, trunks, and carriages. The *wungu* is often used instead of teak. It is of a somewhat finer grain, and, when in full blossom, is the most beautiful tree existing. The *wadang* or *bayur*, a light wood, is well adapted for the masts and spars of small vessels. There are several other similar woods, of which are formed the handles of spears and pikes. There is a close and ponderous wood, the *nangka*, which is used for beams and rafters in the construction of houses, and sometimes for household furniture. There are other woods, heavy, hard, and close in the grain, which are used for the anchors of small vessels, for ships' blocks, for naves of wheels, for handles of tools for carpenters and other artificers, for cart-wheels, for machinery, and such like purposes. There are other light woods, which are useful for canoes, for the handles of axes and other like tools, and which are manufactured into planks. There are various descriptions of woods that are well adapted for household furniture, cabinet ware, &c. of a deep-brown or black colour, and which take a fine polish; others of a lighter colour, and finely grained, that are used for inlaying. There are other kinds of woods of various colours, variegated, white, and black, or of yellowish or brown colours, and very heavy, which are employed for canes, handles, and spears. The bamboo flourishes in great luxuriance and variety. The rattans of Java are, however, inferior to those of Sumatra and Borneo. Many woods afford excellent fuel; and amongst the useful trees may be reckoned the soap tree, of which the fruit is very commonly used in the washing of linen; the *kasemak*, from the bark of which is made a varnish for umbrellas; the *oampang*, from the resin of which the natives prepare a shining varnish for the wooden sheaths of krises; the cotton-tree, from which a silky wool is obtained for stuffing pillows and beds; the wax-tree, from the kernel of which an oil is expressed, which some time after becomes hard, and bears a resemblance to wax, and may be burnt in lamps or converted into candles, affording when burning an agreeable odour; the shrub is also produced which yields the elastic gum from which the India rubber is prepared. This substance is converted into torches, which are employed in searching for edible bird-nests in the caves of the rocks. Few of the trees in Java exude the odoriferous resins which abound in Sumatra, Borneo, and the eastern islands. The camphor tree is unknown. None of the finer kinds of spices, such as the nutmeg, the clove, or the cinnamon, are indigenous to Java; but the few trees planted by Europeans in gardens have thriven well, and there is little doubt that the nutmeg and the clove might be extensively cultivated throughout the island. The vine would also thrive well in some of the eastern provinces; but its growth was always discouraged by the narrow policy of the Dutch, who were afraid lest it should interfere with the wine trade of the Cape of Good Hope. The cottage of every peasant is surrounded with plantations of cocoa-nut trees, which constitute an inheritance that is transmitted from father to son, and which it is reckoned a sacred duty to transmit, and to augment by new plantations. The various species of the palm-tree are found in Java; and, besides the cocoa-nut, there are many trees growing spontaneously, of which the seeds and kernels are used as food. The true sago of Amboyna and the eastern islands is found in a fair, low, and marshy situation, though the preparation of it from the pith of the tree is not known to the inhabitants of Java; but from the *aren* or *sagurus rumpnii*, which abounds in all parts, and, from its various and extensive uses, ranks next in importance to the cocoa-nut, a substance is prepared similar in all respects to the true sago of the eastern islands. Other trees exude gums and balsamic oils. The kubab yields a balsamic oil or jelly, which is much esteemed, which has the smell and taste of camphor, and is taken inwardly for violent coughs, or disorders in the stomach. The benzoin-tree produces an odoriferous gum, of an orange colour, which is a valuable article of commerce. The *upas* or famous poison-tree of Java has long attracted the curiosity of naturalists, and has been the subject of many wonderful, and, as now appears, fabulous tales. It is one of the largest trees in the forests of Java, and rises with a completely naked stem to the perpendicular height of

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sixty, seventy, and eighty feet, when it sends off a few stout branches. The bark, which in old trees is almost half an inch thick, on being cut yields a milky juice, from which a poison is prepared equal in fatality to the strongest animal poisons hitherto known. The inner bark resembles a coarse piece of linen which is worked into ropes, and which, after much bruising, washing, and immersion in water, is worn by the lower classes when working in the fields. But it is remarkable, that after being exposed to a shower of rain, this dress produces an intolerable itching, the effect of a small portion of the poison still adhering to the bark. The story of the tree poisoning the surrounding atmosphere is altogether a fable. It is extremely difficult to penetrate into the forests of Java, from the quantity of underwood and creeping plants with which they are entangled.

Fruits.

"No region of the earth," says Marsden, "can boast of a greater abundance and variety of indigenous fruits than Java. The *mangustin*, pre-eminent for delicacy of flavour amongst all the fruits of the East, of a round form and a purple colour, is found in great abundance. The *dorian*, a large fruit, like the bread fruit in appearance, of a disgusting smell, and of a flavour like a custard, is said, when seasoned with garlic, to become by frequent use extremely fascinating. The *rambutan*, a cool and agreeable fruit, of a delicate sub-acid flavour, grows on a showy and elegant tree. The *lanseh* or *lanseb*, much relished by the lower classes, grows in clusters like grapes, and has a pulpy substance, with a delicate sub-acid flavour. The *pumplemoos*, the Batavian lembu or vine of Bengal, and the shaddock of the West Indies, is in Java of an exquisite flavour; as also the pine-apple, which is much superior to that of Hindustan. There are besides extensive varieties of the atrocarpus or jack-fruit, which grows wild in abundance; of the mango, of which no less than forty varieties are enumerated; the plantain, the guava, the rose-apple, the custard-apple, the papaw, besides dates, pomegranates, tamarinds, figs, annanas, oranges, lemons, citrons, melons, pumpkins. In some of the mountainous tracts are to be found peaches, Chinese pears, and other fruits imported from Japan, the Cape of Good Hope, and China. Of the oil-giving plants there are many. From the *palma christi* is obtained most of the oil that is burned in lamps. There are numerous trees, plants, and shrubs, which supply, from the bark or the leaves, fibres that are converted into ropes, threads, lines used for fishing, thread, and finally cloth, or spun into a kind of stuff resembling silk, gauze, &c. Mats are made from a kind of grass, and from the leaves of various palms; and the paper in common use amongst the Javans is manufactured from the *morus papyrifera*.

The plants and herbs, and the innumerable flowers which bloom in perpetual succession in Java throughout the year, and impregnate the air with their fragrance, present an inexhaustible field for the researches of the botanist. Many of the flowers are used by the natives in adorning their persons, and are remarkable for their fragrance. From the *fula majori*, of which whole fields are cultivated, a water is distilled superior to rose-water; and from the eglantine tree, originally imported from Persia, a rose-water is distilled which is in great repute. The coral trees, of different species, are all elegant and showy; and amongst the trees and shrubs there are some that are rare and curious, such as the *casuarina equisetifolia*, whose pendent branches resemble the hair of the cassowary. The bombax bears a long pod, which contains a silky substance that is used for stuffing cushions. Many varieties of flowers and plants are cultivated in gardens on account of their beauty and fragrance, such as the elastic gum-tree, the *convolvulus jalappa*, the *styrax liquida*, and the mountain cabbage-tree of the West Indies. The pitcher-plant (*nepenthes distillatoria*) is found in the most arid situations, and is provided with a curious contrivance for retaining the rains or the dews which refresh the parched ground. To the stalk which bears the leaves, a small tube, in the form of a pitcher, and covered with a lid, is attached. By means of a hinge or strong fibre passing over the handle, and connected with the leaf, which is contracted when the weather is showery, or when the dews fall, the lid is opened for the reception of the moisture; and when it is filled it closes again, so firmly as to prevent evaporation, and thus water is secured for the sustenance of the plant. Java produces a variety of medicinal plants, many of which are little known in Europe, though several, whose properties have been investigated, are likely to become valuable articles in medicinal practice. It yields also a great variety of culinary vegetables, such as the kurkum, a favourite plant used by the Malays in cooking their fish and flesh, to which it gives the colour and taste of saffron; the pattatas, reckoned a very wholesome root, and eaten either raw or roasted, in which state it has the taste of a chestnut; the foki-foki, which, when boiled in wine with pepper, tastes like an artichoke. All other garden plants, such as endives, cauliflowers, beans, cabbages, pompions, water-melons, yams, potatoes, &c. are produced in great abundance throughout the island.

Animals.

Neither the camel nor the elephant is found in Java, nor have they either the ass or the mule. But they have a male breed of fine horses, strong, fleet, and well made; and a still finer breed is imported from Buna, or the neighbouring island of Sumbawa, which much resembles the Arabian horse in all qualities excepting size. The bull and the cow are common, and the breed has been improved by a species brought from the continent of India. But the animal of most essential use in agriculture is the buffalo, which is a large and fierce animal, heavier than our largest oxen, and well qualified for a beast of burden. Goats of a small size are numerous; sheep are scarce and small. The hog is principally reared by the Chinese. Wild animals abound in the forests. The royal tiger is here as powerful and as large as in Bengal. There is a smaller species of a black kind which is very ferocious, and in size and shape resembles a leopard; there is also the leopard and the tiger-cat. The rhinoceros is amongst the largest quadrupeds found in Java. It is principally met with in the western parts, lying in the deep jungles of the high grass, remote from observation. Deer and antelopes abound in the woods; also hares and rabbits, as well as all the varieties of the wild hog, which are extremely destructive to the plantations. Other smaller quadrupeds, such as the weasel and squirrel, are common. Amongst the feathered tribes are found the cassowary, called emeu by the Indians, a very large and powerful bird; the white eagle, and several varieties of the falcon; also the carrion-crow and the owl, the peacock, two species of parrots, one of which is very beautiful, and sells at a high price. Birds of paradise sometimes visit the island. Pigeons of the most beautiful plumage are found; also pheasants, jingle and pea-fowl, quail, snipes; wild ducks and geese are not so common. The Java sparrow is a very handsome bird. Amongst the most interesting subjects for the study of the naturalist is the small swallow, which forms edible nests, of which large quantities are annually exported to the Chinese market, where they are considered as a very great luxury. The aquatic tribe are numerous. At the mouths of the rivers the cayman or alligator, more resembling the crocodile of Egypt than that of the Ganges, is found lurking for its prey. The water-guana, in length about six or seven feet, infests the rivers and ponds, where it is very destructive. There are various kinds of lizards; amongst others a small one, which is not above eighteen or twenty inches in length. Two spe-

Java.

cies of the turtle are found in the surrounding seas, which abound also in a variety of excellent fish not known in Europe; and in soles and carp, as well as in oysters and shell-fish of every kind. There are thirty-four species of river-fish, many of which are excellent. In the several bays on the shores of the island are numerous sharks, which are often seen swimming around the ships.

The serpent brood are numerous, and of various kinds. It is uncertain whether the boa constrictor be found in Java. There are several which attain to a very large size, from twenty-five to thirty feet in length. One of these, the *ular lalang*, is much dreaded by the natives, and is said to be poisonous. Scorpions and musquitoes abound in marshes; and there are various sorts of dangerous and disgusting vermin, such as ants, spiders, fire-flies, which swarm in the roads, houses, and even bed-chambers of the inhabitants. In the woods is found a venomous spider, the body of which is nearly two inches in diameter, the fore legs and claws nearly four inches in length, and the webs spun by it so strong as frequently to entangle and catch the smaller birds.

Manufactures.

Manufacturing industry can scarcely be said to exist in Java. Weaving is exclusively practised by the women, who make coarse cloths of cotton, and sometimes of silk, for the use of their families. These they dye of various colours; but, with the exception of blue and scarlet, all their dyes are apt to fade. Tanning is carried on in some districts with tolerable success; also saddlery; and there are manufactures in iron, brass, and tin. Salt is manufactured in Java to a great extent, both for the home supply and also for exportation. Under the Dutch government, the manufacture of salt was farmed out to the Chinese as an exclusive privilege; a system liable to much abuse, and which left the price in a great measure at the discretion of the farmer. The farming of salt was abolished under the British regime in 1813. Saltpetre is obtained in many parts of the island, and whilst the French possessed the island, saltpetre works were established under European superintendents; powder-mills, founderies for shells, shot, anvils, &c. and manufactories of swords and small arms. From the resources and industry of this island alone the French were enabled to equip an army of 15,000 men, besides a numerous militia in every district; a proof of the progress of manufacturing industry amongst the natives. The trade of a blacksmith is held in high estimation, and considered almost as a liberal profession; chiefly, it is probable, on account of the value attached to the manufacture of arms. Their small boats and barks are made of various and convenient shapes; but they fail whenever they attempt to construct vessels of any magnitude.

Commerce.

The commerce of Java was very extensive at the period of the Dutch establishment in the Eastern Seas. "But," says Sir Stamford Raffles, "it would be painful to point out how far, or to show in what manner, that commerce was interfered with, checked, changed in its character, and reduced in its importance, by the influence of a withering monopoly, the rapacity of avarice armed with power, and the short-sighted tyranny of a mercantile administration." The Javans were, prior to this time, plentifully supplied both with gold and jewels, and with other valuable articles, in exchange for the produce of their tranquil industry and their fertile soil. Constant requisitions were made by the government for the services of native vessels, at rates far below a just compensation; and native traders were forbidden to trade in any of the articles of the Dutch monopoly. This traffic was almost entirely annihilated, or diverted from its course, by the restrictive policy of the Dutch, and by their monopolies. The commerce of the country revived under the more liberal administration of the British governor Sir Stamford Raffles, one of those great and enlightened men who seemed to value the possession of power only as it enabled him to benefit mankind. This extension of trade appears from the increasing amount of tonnage employed to carry it on. The shipping that cleared out from the port of Batavia in 1812, was 52,375 tons; in 1813, 64,306; in 1814, 72,718. By an official return in March 1816, it appears that the total quantity of tonnage in vessels boarded in their passage through the Straits of Sunda, amounted, in 1812, to 45,000 tons; in 1813, to 56,000 tons; in 1814, to 64,000 tons; and in 1815, to 130,000 tons; and, adding vessels not boarded, the whole tonnage for four years would amount to 390,000. Java has great advantages for its internal trade, from its navigable rivers, by which the produce of the interior is conveyed to the coast, and from its excellent roads. A high post-road, passable for carriages at all seasons of the year, runs nearly the whole length of the island east and west, a distance of 800 English miles; and a high military one, equally well made, crosses the island from north to south; cross roads branching off from these main roads, so that there is easy access to all parts of the island. The internal trade of the island was, however, heavily oppressed by local duties, rendered still more oppressive in the hands of the Chinese, to whom they were farmed out; and by market duties. From this oppression it was only partially relieved by the British. The coasting and foreign trade of Java is carried on in vessels belonging chiefly to Chinese, Arabs, Bugis, natives of Celebes, and in smaller Malayan craft. The island is a great entrepôt for the produce of the whole eastern archipelago; and its merchants, a great proportion of them Chinese, are very rich, and remarkable for honourable dealing and persevering industry. Java exports for the use of the other islands, including the Malayan ports on the peninsula, rice, a variety of vetches, salt, oil, tobacco, timber, Java cloths, brass-wire, edible bird-nests to the value of L.40,000 or L.50,000, a variety of minor articles, the produce of her agriculture and manufactures, besides a considerable quantity of European, Indian, and Chinese goods. The following articles, the exclusive produce of the eastern islands, are collected at its principal ports for re-exportation to India, China, and Europe; tin from Banca; gold-dust, diamonds, camphor, benjamin, and other drugs, edible bird-nests, biche de mer, rattans, bees' wax, tortoise-shell, and dyeing woods, from Borneo and Sumatra; sandal and other fine woods, nutmegs, cloves, and mace, coarse, wild, and damaged spices, kayu-puti, and other pungent oils, from the Moluccas; horses and sapan wood from Sumbawa; Bugis cloths, and many collections for the Chinese market, from Celebes. A very extensive trade is carried on with China in Chinese junks, about eight or ten of which annually arrive from Canton or Amoi with cargoes of teas, raw silk, silk piece goods, varnished umbrellas, iron pots, coarse China ware, sweetmeats, nankeen paper, and numerous other minor articles, for the use of the Chinese settlers, many of whom come annually to Java, where they employ themselves as labourers on their first arrival; but, by frugal habits and persevering industry, they soon acquire property, and become extensive merchants. European vessels carry out from Java to China, tin, pepper, spices, rattans, and betel-nut; and bring back Chinese produce for the European market, a balance of cash, and manufactures for Batavia. Whilst Java was in possession of the English, all kinds of piece goods, opium, and other articles, were imported from Calcutta, Madras, and Bombay, and bills, gold-dust, bees' wax, tin, Japan camphor, sago, and teak-timber, were taken away in return. Under the English rule the trade was free, and great quantities of teak were imported into the markets of Bengal. But since the island was ceded to the Dutch, the old system has been revived, and the teak of

Java has been artificially raised in price two hundred per cent. The latter is of a superior quality to that of Pegu or the Malabar coast; and, notwithstanding that it was monopolized by the Dutch government, it was exported to the Moluccas, to Malacca, and to the Cape of Good Hope, where all the public buildings are constructed of Javan teak. Large quantities of Javan sugar, which is of a superior quality, were exported to Bombay, and also by Arab vessels to the Red Sea, and particularly to Mocha. But Arab traders of capital have since been driven out of the market by the monopolies of the Dutch. Java, since the partial opening of the Indian trade in 1810, has largely imported European manufactures.

It appears from Mr Crawfurd's statement that there does not exist here the same inveterate prejudice against European manufactures as in India and China. Since the opening of the free trade, the fine cottons of Britain have, from their cheapness, in a great measure superseded those of Hindustan. Chintzes are the favourite article, in which the pattern is of much consequence. The taste of the Javanese is for bright colours, red and green in preference to all others, and next to these yellow and brown; whilst black is unsaleable. The pattern should be small, filling the ground without crowding it. White calicoes and cotton cambrics are also purchased by the natives, to be painted by themselves. Although Java lies under the tropics, its mountainous and maritime situation produces a demand for light woollens. These should be cheap Yorkshire cloths, such as cost at Leeds 5s. to 6s. 6d. per yard. Iron, to the extent of 28,000 cwt., and to the value of L.22,500, is annually imported into Java, which is destitute of that important metal. The Swedish is preferred, though British iron has of late been introduced to a considerable extent. Fire-arms and ammunition are the most saleable articles, but their export has hitherto been prohibited by European governments. There has been recently a great extension of demand for our glass and earthen ware. A constant demand, limited only by the means of the purchaser, is also daily increasing for gold lace, and the other European manufactures used as dress, furniture, saddlery, &c.

Manners of the Javanese.

Amongst the two races of people who inhabit the oriental islands, distinguished into the brown coloured race, and the Papuas or oriental negroes, the natives of Java belong to the former. They are under the middle size, the standard for men being five feet two inches, and for women four feet eleven inches. Their complexion is a yellowish brown, generally without any tincture of red. Of this colour they admire the fair specimens, and their standard beauty is a virgin gold; but they consider the European white as a sickly tint. They have a round face, little black eyes, a small nose, and a large mouth, with thick lips. On the head, beard, and other parts of the body, there is a remarkable deficiency of hair. Compared with the Europeans and southern Asiatics, they are considered by Mr Crawfurd as an ill-looking race; but the opinion of Sir Stamford Raffles is, in this respect, more favourable. Their constitution is healthy, and they seem to attain a longevity equal to that of Europeans. Early marriages are as universal as amongst other Asiatics, a man being scarcely ever known single at twenty-five, whilst an unmarried female at eighteen is considered as an old maid. The lot of the female sex differs considerably from what it usually is among Asiatics. They are by no means immured with the same jealousy; British gentlemen have even been admitted to visit the harems of the sultans and chiefs, where they were received by the ladies with all the dignified propriety of persons accustomed to mix in general society. To women the commercial and pecuniary affairs of the family are almost wholly intrusted. Of these privileges and advantages, however, they are said not always to make the very best use. The right of divorce, with which they are indulged equally with the other sex, is carried by them beyond all excusable limits. It is very common for a woman, before the age of thirty, to have divorced three or four husbands; and Mr Crawfurd had one pointed out to him who was living with her twelfth. No difficulty occurs in regard to the disposal of the children, who, in Java, are never viewed in the light of a burden. Besides being easily supported, they are usually few in number, a circumstance ascribed to the hard labour which the mothers undergo, and the consequent frequency of abortion. Besides the management of the household, they weave all the cloths worn in the family, and perform various other offices which in Europe devolve on the other sex. Polygamy is permitted by law, but it is known only amongst the great; and, even with them, the first wife alone is of their own rank, and mistress of the family; the others occupy a place decidedly inferior. The natives of Java were drawn by their Dutch masters in very dark colours; but the English residents, after careful observation, have described them much more favourably. They are generous, warm-hearted, and susceptible of strong attachments. Their affections of kindred are peculiarly forcible; so that, even in civil contests, those fraternal enmities, so conspicuous in other Asiatic states, are scarcely ever observable. The English, who placed confidence in them, found them honest in the intercourse of common life; and they share only in a slight degree those habits of piracy for which the Malay tribes are so notorious. In society they are uncommonly good humoured, courteous, and polite, and are scarcely ever seen in a passion, unless on those occasions when they are hurried to the last extreme of violence. These unhappily too often occur under the impulse of that violent jealousy and revenge which form their ruling passions. The disregard of human life seems to proceed to an excess amongst them scarcely known in any other quarter of the globe. It is stated that, in any part of Java, an assassin may be hired for the moderate sum of fifteen or twenty shillings; but, in general, the injured party conceives it more honourable to decline this cheap mode of redress, and to seek vengeance with his own hand. Some, driven to the extreme of desperation, run furiously into the streets, and kill indiscriminately all whom they meet, till they are themselves overpowered and cut down. This dreadful atrocity, which, by a corruption of the native term, is called "running a muck," is said, however, to prevail, not amongst the native Javanese, but amongst the other Malay tribes resident in the capital.

Religion.

In the ancient religion of the Javanese, which was undoubtedly derived from Hindustan, Siva, with his family, and Buddha, were the chief objects of adoration. Their temples appear, from the late inquiries of our countrymen, to have rivalled in splendour those erected in the native seats of their religion. In the course of the fifteenth century, the whole island of Java was, by Arab traders and settlers, converted to Mahommedanism. This faith, however, which is generally observed with so much strictness, is professed here in a very loose and imperfect manner. It need only be observed, that wine and spirits are not only used without scruple on ordinary occasions, but are even sometimes produced at religious festivals. An extreme indifference prevails as to all its outward observances. In return, superstitious credulity is common to a degree almost unparalleled. A belief in sorcery is universal. If a person write the name of another on a skull, bone, or leg, and suspend it from a tree on haunted ground, where two roads meet, the laws doom to death, himself, his friends, his children, and his children's children. Availing themselves of this credulity, various persons usually start up, in troubled times, as saints, prophets, or as the descendants of one of the ancient kings of Java, and attract a multitude of followers. Christianity has not obtained any footing in Java; and Mr Crawfurd doubts if it ever will, till the conduct of its Indian professors becomes more conformable to its precepts.

The Javanese language is the most copious and improved of any used in the Indian islands. It has Sanscrit for its basis, but with considerable variations. In the beauty of its written characters it is not surpassed by any of the languages of Asia. It is distinguished by its vast copiousness as to particular, and barrenness as to general terms. Thus there are five names for a dog, and seven for a horse, but no general word for an animal. The abstract terms nature, space, and others of that kind, are entirely wanting. All their literature, as is usual among rude nations, is metrical, and may be divided into lyrical compositions or songs; romances founded on Hindu legends; romances founded on modern story; histories of modern transactions; with legal and ethical tracts, chiefly in prose. Of these compositions, the songs, in which feeling and passion are simply expressed, appear to be the most pleasing. The romances consist chiefly of abridged translations of the Mahabarat and Ramayana, from the Hindu original into a now dead Javanese language called the *Kawi*. These versions, being free from the endless prolixity of the originals, may be read with greater pleasure. Java had no history previous to the Mahommedan invasion; and even now, its annals consist merely of metrical legends, which, being written under the eye of the prince whose deeds they relate, cannot be suspected of very strict impartiality. Besides the rudeness of these compositions, there is an absence of that energy, ardour, and sublimity, which have often characterised the poetry of far ruder nations. This seems justly ascribed to the despotic form of the government, which represses all the nobler sentiments natural to independent man, when individual character is permitted to unfold itself.

Government. The government of Java is more absolute than that of any other part of the archipelago, and differs little in this respect from the great monarchies of Asia. There is no rank but what emanates from the sovereign; and no bounds are set to the marks of respect shown by inferiors to the higher classes. No individual, of whatever rank, can stand in the presence of a superior, not even the heir-apparent in that of the sovereign. Whenever a chief appears in public, all his inferiors must throw themselves into the posture called *dodok*, which may be rendered by the English term "squatting," in which they remain till he disappears. Sir Stamford Raffles describes himself as much annoyed at seeing, in one of his progresses, the whole population of the country quitting their work, and remaining fixed in this uneasy posture as long as he remained in sight. They have a language, or at least a modification of the language, which must be used by the inferior in addressing those of higher rank. The revenue of the sovereign, as is usual in Asiatic despotisms, arises from the rent of all the cultivated lands in the country, levied in kind, and in the enormous proportion of one half of the entire produce. This, however, by the allowance of one sixth for reaping, is reduced to about two fifths. It is paid, not into the treasury, but by the king assigning to each of his officers and servants a certain number of cultivators, whose rents he is to receive. The Javan farmer is supposed, on the whole, to be more mildly treated than the Hindoo.

Population. The population of Java, including the small contiguous island of Madura, was found, by a census taken in 1815, to amount to 4,600,000. Of these, three millions are in the provinces immediately subject to European authority; the rest is subject to the native princes. The principal European capitals, Batavia, Samarang, and Surabaya, contain respectively 60,000, 25,000, and 20,000 inhabitants; the chief native capitals, Surakerta and Yug Yukerta, about 105,000 each. The Chinese, amounting to 94,000, form the most active and industrious part of the population; the manufactures of salt, sugar, and arrack, are solely in their hands. Slavery in Java prevails to a much less extent than in the other islands. The slaves do not exceed 30,000; and none of them are native Javans, but obtained by purchase or capture from Celebes or Borneo. The philanthropic measures adopted by Sir Stamford Raffles, with a view to the abolition of the trade, were seconded by the chiefs, and productive, to a considerable extent, of the desired effect. (F.)

JAVELIN, in *Antiquity*, a sort of spear five feet and a half long, the shaft of which was of wood, with a steel point. Every soldier in the Roman armies had seven of these, which were very light and slender.

JAXT, one of the circles into which the kingdom of Wirtemberg is divided. It is 2112 square miles in extent, and comprehends thirty-one cities, thirty-five market-towns, and 1608 small villages and hamlets, with 336,000 inhabitants, who are chiefly Lutherans, but intermixed with some Catholics and Jews. It is subdivided into fourteen bailiwicks. It is a mountainous district, but none of the elevations exceed 2200 feet. It is the source of several rivers, some of which run to the Rhine, and others to the Danube. It is a fruitful province, and better cultivated than most parts of Germany; and it yields abundant crops of wheat, summer and winter barley, rye, oats, potatoes, hemp, flax, and rape-seed. Vineyards are numerous, and produce excellent wine. Its mineral products are iron, vitriol, marble, and alum, and abundance of salt is prepared from natural saline springs. The breed of cattle is good, and forms a part of its exports to France. There are manufactories, chiefly of linen. On the whole, this is the most prosperous circle of the whole kingdom.

JAY, GUI MICHEL LE, distinguished by the Polyglott which bears his name, was born at Paris in 1588. He studied the ancient languages, in which, however, he was but moderately skilled. In 1615, three men of rare merit, Cardinal Duperron, Jacques de Thou, and François de Brèves, had conceived the project of publishing a Polyglott; but, from some circumstances, the design was not carried into effect. Lejay, however, resolved to revive the scheme, and conduct it to a conclusion. He had fortune, he was laborious, and he was not wanting in resources. He associated with himself in the undertaking some of the most learned men of his time. The elder Morin of the Oratory, Philippe d'Aquin, a converted Jew, Godefroy Hermant, a canon of Beauvais, and three Maronites of Lebanon, were charged with revising the different books of the Holy Scriptures, each in the language which he understood; whilst Jacques Sanlecque, a famous artist, cast the characters, and Antoine Vitré or Vitray, printer to the king, undertook the impression. It commenced in 1628, and, after encountering a variety of difficulties and obstacles, was completed in 1645, under the title of *Biblia Hebraica, Samaritana, Chaldaica, Græca, Latina, Arabica, quibus textus originales totius Scripturæ sacræ, quorum pars in editione Complutensi, deinde Antuerpiensi regiis sumptibus extat, nunc integri ex manuscriptis toto fere orbe quæsitis, exemplaribus exhibentur*, in ten volumes. The execution of this work is magnificent; it is indeed a masterpiece of typography; but it literally swarms with blunders, editorial as well as typographical; whilst, by reason of the enormous size of the volumes, the use of them is attended with much inconvenience. Lejay ruined himself by the impression, first, because he would not suffer it to appear under the name of Cardinal Richelieu, who, after the example of Cardinal Ximenes, was ambitious of immortalising his name by such an undertaking; and next, because he made it too dear for the English market, upon which Dr Walton undertook his Polyglott Bible, which, being more commodious, reduced the price of Lejay's. After the death of his wife, Lejay, having taken orders, was made dean of Vezelay, in the Nivernois; and Louis XIV. gave him the post of councillor of state.

JAYES, a town of Hindustan, in the nabob of Oude's territories, fifty-five miles south-east from Lucknow. Long. 81. 30. E. Lat. 26. 15. N.

JAYNAGUR, a town of Hindustan, in the province of Bahar, 122 miles south-south-west from Patna. Long. 84. 25. E. Lat. 24. 1. N.

JEALOUSY is that peculiar passion which arises in the mind from fear that some rival may rob us of the affection of one whom we greatly love, or suspicion that he has already done so. The first sort of jealousy is inseparable from love, before it is in possession of its object; the latter is often unjust, generally mischievous, and always troublesome.

JEAN D'ANGELY, an arrondissement in the department of La Vendeé, in France, extending over 334 square miles, divided into seven cantons, and these into 128 communes, with a population of 70,261 persons. The capital, which gives its name to the arrondissement, is a city situated on the river Boutonne, containing 5460 inhabitants, who are partly employed in the manufacture of serges, druggets, and other kinds of woollen goods, and carry on a considerable trade in wine and brandy. There is also an establishment for making gunpowder. It is in long. 0. 40. 5. W. and lat. 45. 55. N.

JEAN DE LUZ, ST, a town of the arrondissement of Bayonne, in the department of the Lower Pyrenees, in France. It is situated on the sea-shore, on the river Nivelle, and is defended by a fort at the mouth of that stream. It contains about 600 houses, with 2830 inhabitants, and is a place of considerable traffic, being the last town of France on the road to Spain; and it carries on extensive fisheries. Long. 2. 15. 7. W. Lat. 40. 23. 15. N.

JEARS, or GEERS, in nautical language, an assemblage of tackles, by which the lower yards of a ship are hoisted along the mast to their usual station, or lowered from thence, as occasion requires; the former of which operations is called *swaying*, and the latter *striking*.

JEBNA, a town of Palestine, on the site of the ancient city of Gath, containing the remains of a fortress built during the crusades by Foulques, king of Jerusalem; ten miles south of Jaffa.

JEBUSÆI, one of the seven ancient peoples of Canaan, descendants of Jebusi, Canaan's son; so warlike and brave as to have stood their ground, especially in Jebus, afterwards called *Jerusalem*, down to the time of David. (Judges, i. 21; 1 Sam. v. 6.)

JEDBURGH, a royal burgh, the seat of a presbytery, and the capital of a parish of the same name, as well as the county town of Roxburghshire in Scotland. It is beautifully situated in the romantic valley of the Jed, on the left bank of that stream, environed with sylvan banks, and embosomed in venerable orchards. This town is of very ancient date, and the name appears to have been at a former period indiscriminately written Gedworde, Jedworth, Jedwood, Jeddart (still in use amongst the common people), and Jedburgh. The name of the river being anciently written Ged, and perhaps Gad, has afforded an opportunity for antiquaries conjecturing that this parish was the principal seat of the Gadeni, a tribe who inhabited the district between the river Teviot and Northumberland. In the twelfth century David I. founded a monastery here, which greatly enhanced the importance of the town. From the antique choir which remains, in a dilapidated state, some have been led to suppose that a sacred edifice existed on the same site prior to the time of David I., and that the venerable ruin, which still attracts much attention, was not founded, but only rebuilt, by that munificent monarch. He also gave to the canons the chapel of Scarsburgh, lying in a recess of the forest, to the east of the Jed; and at a later period the dependencies of Restennet in Angus, and Cannoby in Dumfriesshire, came into the possession of the monastery. The importance of the town was still further secured by the erection of a castle; but by whom it was founded is not known. It was a royal residence, and for ages continued a place of great strength, the object of eager dispute to the contending kingdoms. It was frequently honoured with the presence of the Scottish monarchs, and was the scene of the royal festivities of Alexander III. on the occasion of his second marriage. After the fifteenth century, the town is frequently mentioned in the history of the wars between the Scotch and English. It was burned by the Earl of Surrey in 1523, at which period it appears to have been a very considerable town; for Surrey, in his despatches to Henry VIII. says, that "there was two times more houses therein than in Berwick, and well builded, with many honest and fair houses in garrison, and six good towers therein." The same writer also extols, in no measured terms, the warlike character and bravery of the men of Jedburgh. Their favourite weapon was the Jedwood axe; and their war-cry or slogan, "Jedworth's here." But an account of the various battles and skirmishes in which they distinguished themselves belongs rather to the history of the county, than to a description of the town. At the present day, Jedburgh has four principal streets, crossing each other at right angles, and terminating in a square or market-place. They are wide and clean, and the houses are well built. In recent times the town has been generally improved, and many elegant, if not spacious buildings have been erected. It contains numerous handsome shops, in which all the necessaries and most of the luxuries of life can be readily obtained. It is celebrated for the production of excellent bread, which is exported in great quantities to the north of England, as well as to the surrounding villages of the county. It is entitled to hold two markets every week, on Tuesday and Saturday. The Tuesday's market is well attended, and grain is then sold by sample to a considerable extent. There are two banks in Jedburgh, branches of the British Linen Company and of the National Bank. Besides the established church, Jedburgh contains several meeting houses for dissenters, who are here a numerous body. The principal manufactures are blankets, flannels, tartans, shawls, shepherds' plaidings, hosiery, lamb's-wool yarn, and carpets; and the town also derives part of its income from fruit, which is produced in considerable quantities in private gardens. There is here an excellent grammar and English school, united in 1804, several subscription libraries, a savings bank for the district, a dispensary, one or two religious societies, and there are letter-press printers in the town. An establishment for making printing presses, on a new principle of construction, has likewise been of considerable benefit to Jedburgh. It is governed by a council, consisting of a provost, four bailies, a dean of guild, and eighteen ordinary councillors. There are eight incorporated trades, who annually elect their own deacons and office-bearers, and four of these deacons are admitted into the council to represent the trades for the year. Jedburgh unites with Haddington, North Berwick, Lauder, and Dunbar, in sending a member to parliament. The revenue of the burgh amounts at present to L.573 per annum, being chiefly derived from the rent of the mills. Jedburgh is forty-six miles south of Edinburgh, ten west of Kelso, and twelve north of the borders of England. The population of the burgh amounted in 1821 to 2500, and in 1831 to 3709.

JEDO, or Jeddo, a large city of Japan, the residence of the emperor, and the capital of the country, as it is by much the largest city of the empire, from the resort of princes and lords, who, with their numerous families and servants, swell the train of the imperial court. It is situated in the province of Musasi, in 35. 32. of north latitude, on a large plain at the end of the gulf, which is so shallow, with a muddy clay at the bottom, that no ships of any considerable size can come up to the city, but must be unladen a league or two below it. According to the Japanese accounts, the city is seven miles long, five broad, and twenty in circumference. It is not enclosed with a wall, but is intersected by many broad ditches and canals, with high ramparts raised on both sides, on the top of which are planted rows of trees. A large river, rising to the west of the city, runs through it, and loses itself in the harbour. It sends off a branch, which divides itself into five channels, over each of which is a stately bridge. Jedo is not so regularly built as most other cities of Japan, though in some parts, which have been burnt down and rebuilt, the streets cross each other at right angles. The houses are small and low, being built of wood, with thin clayed walls, divided within into rooms by paper screens, the floors covered with fine mats, the roofs with shavings of wood. They consist entirely of combustible materials, so that we need not wonder at the havoc which fires frequently occasion. In this city are many stately palaces, the residences of the nobles and princes, who are obliged to reside six months of the year at the imperial court. They are distinguished from other houses by large court-yards and stately gates; fine varnished staircases, of a few steps, lead up to the door of the house, which is divided into several magnificent apartments, all on one floor, only one story high, and not adorned with towers, as the castles and palaces are where the princes and lords of the empire reside in their hereditary dominions. There are, besides, numerous temples, monasteries, and other religious buildings. The castle and residence of the emperor, which is a magnificent structure, is situated about the middle of the city. It is of an irregular figure, inclining to the circular, and is five Japanese miles in circumference. It consists of two enclosures; the innermost and third castle, which is properly the residence of the emperor; two other strong, well-fortified, but smaller castles at the sides; and some large gardens behind the imperial palace. The first and outermost castle takes in a large space of ground, which encompasses the second and half the imperial residence, and is enclosed with walls and ditches, and strong, well-guarded gates. This is the residence of the princes of the empire, with their families, who live in commodious and stately palaces, built in streets, with spacious courts shut up with strong and heavy gates. The second castle takes in a much smaller space of ground. It fronts the third, the residence of the emperor, and is enclosed by the first, but separated from both by walls, ditches, &c. Here are the stately palaces of some of the most powerful princes of the empire, the councillors of state, the prime ministers, chief officers of the crown, and such other persons as give immediate attendance on the emperor. The castle where the emperor himself resides is enclosed with a thick, strong wall of freestone, having bastions standing out, much after the manner of the European fortifications. On the top of this wall are erected several long buildings and square guard-houses, built in the form of towers, and several stories in height. Those on the side where the imperial residence is are all of freestone of an extraordinary size. It is adorned with a square tower, raised many stories high, adorned with beautiful bended roofs, gilt dragons at the top and corners, and many other fantastical ornaments. The second castle is very small, and more like a citadel; and the third lies on the side of the second, and is of much the same structure. In these two castles are bred the imperial princes and princesses. The rising ground behind the imperial residence is beautified with gardens and magnificent orchards. The palace itself is only of one story, but it is of great height, and contains many long galleries and spacious rooms, which, on removing the screens, may be narrowed or enlarged as occasion requires. The structure of all the interior apartments is fine, according to the fashion of the country; the ceilings, beams, and pillars are of cedar, or camphire, or a peculiar sort of wood, which runs into flowers and other curious figures, and is in some apartments covered only with a thin transparent layer of varnish, in others japanned, or curiously carved with birds and branched work neatly gilt. The floor is covered with the finest white mats, bordered with gold fringes or bands; and this is all the furniture to be seen in the emperor's palace. There are two strong rooms, in which are kept the imperial treasures. Besides being the residence of the court, and the seat of luxury, Jedo contains flourishing manufactures, and carries on an extensive commerce. From the combustible materials of which the houses are formed, it is liable to dreadful conflagrations. One that occurred in 1703 is supposed to have consumed 100,000 houses. Long. 140. E. Lat. 36. 30. N.

JEFREMOW, a city of the province of Tula, in Russia, the capital of a circle of the same name, on the river Metscha. It contains six wooden churches, and one of stone, 399 houses of different structure, and 2600 inhabitants. Long. 38. 54. E. Lat. 53. 40. N.

JEFFERSON, Thomas, one of the founders of American independence, and president of the United States, was born at Shadwell, in Albemarle county, Virginia, on the 2d of April 1743. His ancestors had at an early period emigrated to that province, and his father had been one of the commissioners for determining the boundary between Virginia and North Carolina. Having completed his education at William-and-Mary College, Williamsburg, he became a student of law under George Wythe, afterwards chancellor of the state of Virginia; and upon coming of age, he was admitted to the bar, appointed a justice of peace for the county in which he lived, and soon afterwards returned as one of its representatives in the provincial legislature.

But the position of public affairs early led him to contemplate questions far more comprehensive and important than any of those connected with the administration of his native state. As early as the year 1763 a spirit of opposition to the British government had manifested itself in the province, and continued gradually to increase, until, in 1769, it assumed the shape of a substantive determination not to import articles from the mother country. This resolution Mr Jefferson not only signed, but used all his influence to promote. In the beginning of 1773, a general system of resistance was first organized, by the formation of committees of correspondence in the different provinces. This plan, devised and matured by Jefferson, was eagerly adopted; and, when the measures of the British government in 1774 showed the increased necessity of opposing to them a united and resolute resistance, its benefits became strikingly apparent. The passing of the Boston port act, and the bills which immediately followed that measure, had, in the opinion of the colonists, filled up the measure of oppression and insult. The breach with the mother country daily became wider; and, as a crisis was evidently approaching, Jefferson's plan served not only to concentrate the general spirit of resistance, but also to give it a suitable direction. About this time he published a Summary View of the Rights of British America, which he intended as an exposition, to be laid before the sovereign, of the wrongs that country had suffered, and the sort of redress she was prepared to demand. For this publication, Lord Dunmore, the governor, threatened to prosecute him, on a charge of high treason, and also dissolved the legislature, which by its resolutions had sanctioned similar doctrines. In the following year, when the legislature was again assembled to consider the conciliatory propositions which had been sent out by the British ministry, Jefferson was appointed a member of the committee to whom these were referred, and he drew up the reply which was presented by that body; a document of great importance with reference to the history of the period to which it refers. But he had scarcely completed this task when he was called to perform a part on a wider field of action. The colonies having resolved to unite together, and send delegates to a general congress, Mr Jefferson took his seat as a member of that body, then assembled at Philadelphia, on the 21st of June 1775, and immediately became one of its most prominent members. In the following summer, when, from the tone of the debates in congress, and the general expression of public opinion, it appeared that the time had arrived for an entire and final separation from Great Britain, a committee was appointed to draw up a declaration to that effect. Of this committee Mr Jefferson was chairman, and, in conformity to the instructions of congress, he prepared the declaration of independence, which, after a few alterations, was adopted on the 4th of July 1776. This is by far the most memorable event in his life.

During the summer of this year, Mr Jefferson took an active part in the public business; but being obliged in the autumn to return to Virginia, he was, in his absence, appointed, in conjunction with Dr Franklin and Mr Deane, a commissioner to the court of France, for the purpose of arranging with the government of that country, treaties of alliance and commerce. Owing to ill health, and other causes, however, he declined the appointment, and shortly afterwards resigned his seat in congress; but being elected to the first legislature assembled under the new constitution of Virginia, he applied himself to introduce various changes and amendments into the laws and institutions of that state, particularly enactments for preventing the importation of slaves, destroying entails, abolishing the right of primogeniture, overthrowing the church establishment, and remodelling the whole of the statutory law. In June 1779 he was elected governor of Virginia, and reelected the following year. This was a season of imminent peril. The state, invaded on the north and the south, was ravaged by the troops of Tarleton and Arnold, and he himself was the object of especial pursuit. But amidst all the difficulties with which he was surrounded, Jefferson conducted the affairs of the state with so much prudence and energy, that, after the expiration of his term of service, the legislature passed an unanimous resolution, expressive at once of their gratitude, and of the high sense they entertained of his prudence, ability, and integrity. In June 1783, Mr Jefferson was again sent to congress as the delegate of Virginia, and, as a leading member of that body, was intrusted with the preparation of the address made by congress to General Washington, when he resigned his commission, and withdrew from public life. In May 1784, congress having decided that, in addition to Mr Adams and Dr Franklin, another minister plenipotentiary should be appointed, for the purpose of negociating treaties of commerce with the French government, Mr Jefferson was immediately elected to this office, and in the month of July sailed for France, where he arrived on the 6th of August. He remained in Europe until the 23d of November 1789, and, during his stay, visited Holland, the north of Italy, and the principal seaports on the southern and western coasts of France. He also crossed over to England, and, in concert with Mr Adams, endeavoured to negociate a commercial treaty with the British government; but their efforts were unavailing, and, after a fruitless visit of seven weeks, he returned to Paris. Whilst Mr Jefferson resided in France, he was not only engaged in various diplomatic negociations of importance to his own country, but was received with marked kindness by men of letters, science, and political distinction. He was likewise an eye-witness of the extraordinary occurrences in public affairs which took place in rapid succession towards the close of his sojourn in the French capital; he had become acquainted with many of the leading men of the national assembly, who were disposed to seek his advice, and place confidence in his opinions; and, as the representative of a free nation, he was an object of interest and attention to the principal actors in the new scenes which had opened upon France.

But his stay was not protracted till that fatal period which was darkened by the sanguinary excesses of popular frenzy; and the interest which he took in the French revolution was consequently warmed by the hope that a great people were about to shake off their fetters, and, by a peaceful but decisive effort, to establish rational liberty upon the solid foundation of improved institutions. In November 1789 he returned on leave of absence to the United States, and there accepted the office of secretary of state offered him by General Washington, instead of resuming his post as minister at the court of France. Whilst in the department of the state, Mr Jefferson laid down those general maxims relative to foreign intercourse, which have ever since been regarded with approbation by the American people, and developed those principles which, in his estimation, ought to govern the conduct of a neutral nation. He understood the true interests of his country: he felt that she required time to consolidate her new institutions, and to strengthen the foundations of the freedom she had conquered; and he laboured assiduously to impress his convictions on the minds of his countrymen. In December 1793, Mr Jefferson resigned his office, and having retired to private life, devoted himself to the education of his family, the cultivation of his estate, and the pursuit of those studies which he had long abandoned, but now resumed with fresh ardour. But he was not long permitted to enjoy the tranquillity of retirement. In September 1796, General Washington having made known to the people his wish not again to be a candidate for the presidency; and the two parties which had gradually grown up in the republic finding it impossible to unite, as in the case of Washington, in the choice of one individual to whom the administration of public affairs might by common consent be committed; Mr Adams was selected by the federalists, and Mr Jefferson by the democratic party, as their respective candidates; and, upon counting the votes, the former, in whose favour there appeared the higher number, was declared president, and the latter vice-president. At the next election, however, when again put forward as the popular candidate, he proved successful in his opposition to Mr Adams; and, although an accidental equality of votes between him and the person simultaneously chosen as vice-president raised a question which had not been provided for by the constitution, and thus gave his opponents an opportunity of contesting the validity of his election, yet, after a severe struggle, he was declared duly elected, and, on the 4th of March 1801, entered upon his first presidential term. The administration of Mr Jefferson embraced a long and interesting period in the history of the United States, and was distinguished by important measures, which contributed, in no inconsiderable degree, to promote the prosperity and increase the happiness of the free nation at the head of which he was placed. Under it various aggressions were promptly chastised; the attempt made by the agents of the Spanish government to obstruct the free navigation of the Mississippi was repelled; and the vast territory of Louisiana, affording an independent outlet for the western states, was purchased, and placed under the republican institutions of America. During the same period, the internal policy of the United States underwent important changes. Measures were adopted for liquidating the public debt; the judicial system was improved; a rigid economy controlled and regulated the public expenditure; all useless offices were abolished; and the president himself set the example of voluntarily relinquishing unnecessary power and patronage. The public approbation formed the best reward of these sacrifices; and hence, when Mr Jefferson's term of service had expired, he was again elected by a majority which had increased from eight votes to one hundred and forty-eight. In his inaugural address, delivered on the 4th of March 1805, he declared his firm determination to continue to act upon those principles on which he believed it to be his duty to administer the affairs of the commonwealth, and which had already been sanctioned by the unequivocal approbation of the country. But he had scarcely entered upon office when an event occurred which seemed calculated to disturb the domestic tranquillity of the United States, if not to endanger the stability of the union itself. This was the conspiracy of Colonel Burr, a man of an ardent and ambitious character, who, disappointed formerly in attaining the first office of the government when it seemed within his grasp, and afterwards superseded in the second by the election of Mr Clinton, now sought, by desperate means, either to establish a new republic in the Spanish provinces of the west, or to break up the federal union in his own country. But his scheme was discovered, and although, when apprehended and brought to trial on a charge of treason, he obtained a verdict of acquittal, yet enough came out in evidence to show the government the extent of its danger, and to indicate the measures necessary to prevent its recurrence. At this period, too, the foreign relations of the United States became greatly embarrassed, in consequence of the war which raged in Europe. Nearly the whole of their revenue depended on commerce; and on this serious aggressions had been made by both the belligerent powers, France and Britain; whilst the right of search claimed by the latter was resented, as at once contrary to the public law of nations, insulting to the American flag, and inconsistent with free navigation. In this view, the natural and obvious remedy was a declaration of war. But, as it was conceived that the interests and situation of America required the previous trial and failure of all other means of obtaining justice, an embargo was resorted to, and a measure for establishing one passed congress on the 22d of December 1807, in consequence of the recommendation of the president. After this embargo had existed a year, however, overtures were made by the British government, indicating a disposition to abate somewhat of its pretensions; and as these had been preceded by the recall of some of those orders in council to which the Americans most strongly objected, an accommodation was effected without difficulty, because in fact the non-intercourse system had proved more prejudicial to the commercial interests of the United States than to those of Great Britain.

Affairs were in this situation when, on the 3d of March 1809, Mr Jefferson's second term of office expired, and with it also terminated his political career. He had now attained the sixty-fifth year of his age, and had for forty years been almost without interruption engaged in the most arduous public duties. He had passed with honour and credit through the various stations to which the service of his country had called him, and he now resolved to quit the scene where he had so long acted a prominent part, whilst yet unoppressed by the infirmities of age, and to pass the evening of a busy life in the calmness of domestic retirement. From this time until his death, which took place on the 4th of July 1826, he resided chiefly at his favourite retreat, Monticello; sometimes occupying his time with publications of his private correspondence, and at others connecting himself with rising institutions formed to promote the advancement of science, literature, or taste. He was sought out in his retirement by strangers of all nations who visited America, and also by the natives of every part of his own country, who regarded him as "their guide, philosopher, and friend." His residence was the abode of dignified ease and unostentatious hospitality; in the calm enjoyments of Monticello, he forgot both the toils and the dangers of his long political career; he took the deepest interest in everything which seemed calculated to advance the improvement or increase the happiness of mankind; at once practical and benevolent, he was constantly studying the welfare of his fellow-creatures, and endeavouring to promote every plan which tended to produce or increase it. Amongst his labours of this kind, the most prominent consisted in the exertions he made for the improvement of education in Virginia, by the establishment of an university at Charlottesville, a town at the foot of the mountain where he resided. This institution, commenced by his own private donations, and those which he succeeded in obtaining from his friends, received the sanction of the legislature; Mr Jefferson's plans, having for their object to combine elegant learning with strictly useful knowledge, were approved of; he himself was appointed rector of the new university; and from this time forward he devoted himself to consolidate the establishment which he had founded. Indeed all his thoughts and means were employed to insure its success.

"Thus," says an American biographer, "glided on the evening of Mr Jefferson's patriotic and benevolent life; as age wore gradually away the energies of his body, his mind shone with intelligence undiminished; and his efforts and desires for the progress of human happiness and knowledge knew no change. Years, however, had crowded upon him; and when the increase of infirmities at length prevented him leaving his chamber, he remarked to the physician who sought to assist him by the aid of his art, that 'the machine had worn out, and could go on no longer.' During the spring of 1826, he had suffered from increasing debility; but it was not until the 26th of June that he was obliged to confine himself to his bed. The strength of his constitution, and freedom from bodily pain, for a short time encouraged the hope that this confinement would be only temporary; but his own conversation showed that he did not himself so regard it. 'Do not imagine,' he said to those around him, 'that I feel the smallest solicitude as to the result. I do not indeed wish to die, but I do not fear to die.' His temper retained all its usual cheerfulness and equanimity; his only anxiety seemed to be for the prosperity of the university, and he expressed strongly his hopes that the state would not abandon it: he declared that if he could see that child of his old age fairly flourishing, he was ready to depart, to say 'nunc dimittis domine,' a favourite quotation with him. On the 2d of July he appeared free from disease, but his weakness was such that his physicians expressed a doubt whether his strength would prove sufficient to restore him. Conscious himself that he could not recover, and without any bodily or apparently mental pain, he calmly gave directions relative to his interment, which he requested might be at Monticello, without parade or pomp; he then called his family around him, and conversed separately with each of them; to his beloved daughter, Mrs Randolph, he presented a small morocco case, which he requested her not to open till after his death. When the sad limitation had expired, it was found to contain an affectionate poetical tribute to the virtues of her from whom he was thus torn away. He desired, if any inscription were placed on his tomb, he should be described only as 'the author of the declaration of independence, of the statutes of Virginia for religious freedom, and the father of the university.' On Monday, the following day, he inquired of those around him with much solicitude what was the day of the month; they told him it was the 3d of July. He then eagerly expressed his desire that he might be permitted to live to another day, to breathe the air of the fiftieth anniversary of the declaration of independence. His wish was granted: the morning of the 4th of July 1826 found him still living; and after declaring himself gratified by the affectionate solicitude of his family and servants, and having distinctly articulated these words, 'I resign myself to my God, and my child to my country,' he gradually expired without a murmur or a groan."

At the time of his death Mr Jefferson had just entered the eighty-fourth year of his age. In person he was above six feet in height, and, though thin, erect and well formed. His complexion was fair, his forehead broad, and his face of a square form, with a thoughtful expression. His address was cordial, and his manner simple, cheerful, and unassuming, yet mingled with a certain degree of native dignity; in his disposition he was full of liberality and benevolence; in his temper he displayed the greatest equanimity, never being known to give way to passion, nor, even during the excitement of political contentions, to indulge in angry or vindictive feelings. His attachment to his personal friends was warm and stedfast; to them he communicated without reserve all that he thought or felt; in regard to them he exercised no diplomatic caution, nor entertained any ungenerous distrust; and he had his reward in that unflinching support which he received from them on every emergency. His application was constant and severe; and his habits were so exact, that in a cabinet abounding with papers, all were arranged in such a manner that any one might be instantly found. Considered intellectually, however, Mr Jefferson does not appear to us to occupy the distinguished rank which has been generally assigned to him by his countrymen, particularly by his eloquent eulogist Mr Webster. On the contrary, he seems to have been one of those men of plain, practical good sense, calm temperament, methodical habits, and persevering application, who make the most of their faculties, and are, upon the whole, much better fitted to excel in the conduct of business than to obtain distinction in pursuits of a higher order, or to stamp the impression of their genius upon the science, the literature, the philosophy, or the legislation of their time. Jefferson was perhaps at the head of the class to which he belonged, but that class was not a high one; and, in truth, he had always been more remarkable for the share which he took in the early formation of the American republic, than for any very predominant superiority of understanding. (*American National Portrait Gallery*, part xxiii.; Jefferson's *Memoirs*, vol. i.; *Edinburgh Review*, vol. xxxi. p. 139; *North American Review*, No. 86.) (A.)

JEFFREYS, Sir George, Baron Wem, commonly called *Judge Jeffreys*, was the sixth son of Mr John Jeffreys, of Acton, in Denbighshire; and was educated at Westminster School, whence he removed to the Inner Temple, where he applied himself to the study of the law. Alderman Jeffreys, who was probably related to him, introduced him among the citizens of London; and being a merry bottle companion, he soon came into great business, and was chosen their recorder. He was afterwards chosen solicitor to the Duke of York; and in 1680 he was knighted, and made chief justice of Chester. At length, resigning the recordership, he obtained the post of chief justice of the king's bench, and, soon after the accession of James II. the great seal. During the reign of King Charles II. he showed himself a bitter enemy to those dissenting ministers who, in that time of persecution, were tried by him. He was one of the principal advisers and promoters of all the oppressions and arbitrary measures carried on in the reign of James II.; and his sanguinary and inhuman proceedings against Monmouth's unhappy adherents in the west will for ever render his name infamous. Whenever the prisoner was of a different party, or whenever he could please the court by condemning him, instead of appearing, according to the duty of his office, as his counsel, he would scarcely allow him to speak for himself, but would load him with the grossest and most vulgar abuse, browbeat, insult, and turn to ridicule the witnesses that spoke in his behalf, and even threaten the jury with fines and imprisonment if they made the least hesitation about bringing in the prisoner guilty. Yet it is said, that when he was in temper, and matters perfectly indifferent came before him, no one became a seat of justice better. Nay, it even appears, that when he was under no state influence, he was sometimes inclined to protect the natural and civil rights of mankind, of which the following instance has been recorded. The mayor and aldermen of Bristol had been used to transport convicted criminals to the American plantations, and sell them by way of trade. This turning to good account, when any pilferers or petty rogues were brought before them, they threatened them with hanging, and then some officers who attended earnestly persuaded the ignorant, intimidated creatures to beg for transportation, as the only way to save their lives; and in general the advice was followed. Then, without more form, each alderman in course took one, and sold him for his own benefit; and sometimes warm disputes arose between them about the next turn. This infamous trade, which had been carried on for many years, coming to the knowledge of the lord chief justice, he made the mayor descend from the bench, and stand at the bar in his scarlet and fur, with his guilty brethren the aldermen, and plead as common criminals. He then obliged them to give securities to answer informations; but the proceedings were stopped by the Revolution. However, the brutality which Jeffreys commonly showed on the bench, where his voice and visage were equally terrible, at length exposed him to a severe mortification. A scrivener of Wapping having a cause before him, one of the opponent's council said he was a strange fellow, and sometimes went to church, and sometimes to conventicles, and it was thought he was a trimmer. At this the chancellor fired. "A trimmer!" said he; "I have heard much of that monster, but never saw one. Come forth, Mr Trimmer, and let me see your shape." He then treated the poor fellow so roughly, that, on his leaving the hall, he declared he would not undergo the terrors of that man's face again to save his life, and that he should certainly retain the frightful impressions of it as long as he lived. Soon afterwards, when the Prince of Orange landed, the lord chancellor, dreading the public resentment, disguised himself in a seaman's dress in order to leave the kingdom, and was drinking in a cellar, when this scrivener, coming into the cellar, and seeing again the face which had filled him with such horror, started; upon which Jeffreys, fearing he was known, feigned a cough, and turned to the wall with his pot of beer in his hand. But Mr Trimmer going out, gave notice that he was there; and the mob rushing in, seized him, and carried him before the lord mayor, who sent him with a strong guard to the lords of the council, by whom he was committed to the Tower, where he died in 1689. It is remarkable, that the late Countess of Pomfret met with very rude insults from the populace on the western road, solely because she was grand-daughter to the inhuman Jeffreys.

JEGHEDERPOOR, a town of Hindustan, in the province of Gundwana, twenty miles south from Bustar. Long. 82. 21. E. Lat. 19. 26. N.

JEHANABAD, a town of Hindustan, belonging to the Mahrattas, in the province of Khandesh, three miles south from Boorhanpoor. Long. 76. 21. E. Lat. 21. 18. N.

JEHENABAD, a town of Hindustan, in the province of Bahar, thirty-three miles south by west from Patna. Long. 82. 5. E. Lat. 25. 13. N.

JEHOVAH, one of the scriptural names of God, signifying the Being who is self-existent and gives existence to others. So great a veneration had the Jews for this name, that they discontinued the custom of uttering it, and hence its true pronunciation was forgotten. They called it *tetragrammaton*, or the name of four letters; and believed that whoever knew the true pronunciation of it could not fail to be heard by God.

JEHUNGSEAL, a small town of the Afghan territories, in the province of Mooltan, thirty miles north-east from the city of Mooltan. Long. 71. 40. E. Lat. 30. 54. N.

JEJUNUM, the second of the small guts, so called from the Latin *jejunus*, hungry; because it was always found empty. See ANATOMY.

JEJURRY, a Mahratta town of Hindustan, in the province of Bejapoor. This place is noted for a fine Hindu temple, built of hewn stone, and dedicated to an incarnation of Mahadeva or Siva, under the form of Khandeh Row, which he assumed to destroy an enormous giant named Manimal. The temple has very ample revenues, about L.6000 annually being expended on account of the idol, for whom horses and elephants are maintained; and who, with his spouse, is washed every day in rose and Ganges water, which has to be brought a distance of 1000 miles. About 250 dancing girls are attached to the establishment, with many Brahmins, and beggars innumerable. The revenues are derived from the donations of the pious, consisting of houses, lands, and money. This is a noted place for penance; and, at a particular season of the year, a number of persons, in order to expiate their sins, undergo the penance of swinging on a kind of gibbet, suspended by hooks passed through the fleshy part of the back. Twenty-eight miles south-east from Poonah. Long. 74. 17. E. Lat. 18. 16. N.

JELASIR, a town of Hindustan, in the province of Agra, twenty-eight miles north-east from the city of Agra. Long. 78. 15. E. Lat. 27. 30. N.

JELATMA, a city of the Russian province of Tambow, the capital of a circle of the same name, on the river Oka. It is an ancient and large place, containing eight stone and two wooden churches, several public buildings, and 778 houses, with 5800 inhabitants. It has considerable manufactures of linen and sail-cloth. Long. 42. 28. E. Lat. 55. 5. N.

JELEZ, a town of the province of Orel, in Russia, the capital of a circle of the same name, on the river Alt. It is a very ancient city, containing twelve stone and two wooden churches, 1290 houses, and 7950 inhabitants. Long. 38. 33. E. Lat. 52. 38. N.

JELEZENKA, a small river in the government of Irkoutsk, in Asiatic Russia, which falls into the Irtysch.

JELEZENSKAIA-CREPOST, a port of Asiatic Russia, on the right bank of the Irtysch, in the government of Tobolsk. It contains a church and 130 houses, and is surrounded by a fertile country very carefully cultivated. It was formerly built of wood, but has since been constructed more regularly of earth. Lat. 53. 51. N.

JELISAWETGRAD, a city of Russia, in the province of Cherson, the capital of a circle of the same name. It stands on a beautiful plain on the banks of the river Ingul. It is fortified, and defended by a strong citadel. It contains 1500 houses, and 12,000 inhabitants, consisting of various tribes and countries, attracted by large fairs held there in the autumn. Long. 32. 22. E. Lat. 48. 30. N.

JELLALABAD, a town of Hindustan, in the province of Delhi, and district of Bareilly, forty-four miles south by east from Barielly. Long. 79. 37. E. Lat. 27. 45. N.

JELLALABAD, a town of Afghanistan, in the province of Cabul, situated in the rich plain of Jellalabad. It was formerly of great note, and is still of considerable importance. It has a public market, and the adjacent district produces a coarse sugar. Seventy-three miles east-south-east from the city of Cabul. Long. 69. 46. E. Lat. 34. 6. N.

JELLALÆAN, or GELALÆN *Calendar, Epoch, and Year*. See CALENDAR and CHRONOLOGY.

JELLY, a form of food or medicine, prepared from the juices of ripe fruits, boiled to a proper consistence with sugar; or the strong decoctions of the horns, bones, or extremities of animals, boiled to such a degree as to be stiff and firm when cold, without the addition of any sugar.

JELPESH, a town of the province of Bengal, and district of Ringpoor, sixty-five miles north-north-west from Ringpoor. Long. 88. 25. E. Lat. 26. 30. N.

JEMAULABAD, a town and fortress in the south of India, province of Canara, which was originally called Narasingha Augady. The first, which was built by Tippoo, stands on the summit of an immense rock, which may be deemed impregnable, as it is wholly inaccessible except by one narrow way. The nature of the access to it, however, renders the approach to it in the face of an enemy nearly as difficult as the ascent; so that a very small body of men with artillery are adequate to blockade a strong garrison, which renders the place of little use, excepting as a safeguard for treasure or records. After the fort was built by Tippoo, he placed in it a khiladar or commandant, with a garrison of 400 men; and the town at that time contained 1000 houses, and carried on a considerable trade. On the invasion of Mysore, the Coorg rajah destroyed the town, and carried away half the inhabitants; the remainder made their escape into the woods, and only about twenty houses have since been rebuilt. After the fall of Seringapatam, it sustained a siege of six weeks from the British, when, being bombarded, it was taken, and, the commander having poisoned himself, his principal officers were hanged. It was afterwards surprised and taken by a band of insurgents or plunderers, when it was reduced, after a blockade of three months, and all that did not escape were summarily executed. The surrounding country is woody. Long. 75. 24. E. Lat. 13. N.

JEMAULNAIG, a town of Hindustan, in the Balaghaut ceded territories, situated on the north side of the Pennar River, forty-one miles north-west from Cuddapah. Long. 78. 28. E. Lat. 14. 48. N.

JEMLAH, a small district of Hindustan, situated between the thirtieth and thirty-first degrees of north latitude. It was formerly an independent state, but is now tributary to the rajah of Nepaul. It is said to be nearly of the same extent as that of Nepaul, but to be more contiguous to the great Himalaya ridge of mountains, and more chequered with low hills. It produces a species of rice which is adapted to the climate of northern countries. Its capital is called Chinnochin, but has not been visited by Europeans.

JEMMAPPES, a large village of the Netherlands, in the province of Henegau, and circle of Mons. It stands on the river Haine, and contains 2838 inhabitants, who are busily occupied in the numerous coal-mines and the mill-stone quarries with which it abounds. It is remarkable for the decisive battle fought there in 1792, when the French, commanded by Dumouriez, defeated the Austrian army under Clairfayt, which led to the subjugation of Brussels and the rest of Flanders.

Jena || Jenyns.

JENA, a city of the grand duchy of Saxe-Weimar, in Germany, the capital of a circle of the same name. It stands in a beautiful valley, through which the river Saale runs, and is surrounded with hills, whose sides are covered with vineyards. It contains three Lutheran and one Catholic church, three hospitals, and 795 houses, with about 5500 inhabitants. It is the seat of the higher courts of law of the duchy, and of some of the revenue boards. Its chief celebrity has arisen from its university, founded in 1558. The number of professors is very great, and among them have always been some of the highest literary characters in Germany. It possesses institutions for education in physic, in mathematics, in medicine, in midwifery, in anatomy, mineralogy, surgery, veterinary practice, and a public library of more than 30,000 volumes. In consequence of a suspicion of the propagation of revolutionary principles, the number of students have, since 1818, been diminished, and now amount only to about 550. Jena is celebrated for the battle fought near it in October 1806, when Bonaparte vanquished and dispersed the Prussian army commanded by the Duke of Brunswick.

JENEAHGUR, called also Jagneh, a town, and also a strong and celebrated fortress, of Hindustan, province of Bejapoor, situated upon a rock with an extensive tableland. It was built about the year 1443, by Mulik al Tajur, generalissimo of the Bhamenee sultan. It afterwards came into the possession of the Bejapoor dynasty, from whom it was taken by the Moguls, and was the chief station of Aurungzebe's army during his war against the Mahratta chief Seraje. It now belongs to the Mahrattas. Long. 73. 45. E. Lat. 20. 15. N.

JENIDSCHE-Bardar, a town of European Turkey, in the circle of Salonica. It is an open place, on the river Bardar, with several mosques and Greek churches, and charitable institutions. It contains 6000 inhabitants, who manufacture cotton goods extensively.

JENJAPOOR, a town of Hindustan, province of Bahar, and district of Tyrhoot, eighty miles north-east from Patna. Long. 86. 15. E. Lat. 26. 14. N.

JENKINS, Sir Leoline, a civilian and statesman of considerable note, born in Glamorganshire about the year 1623. Having become obnoxious to the parliament during the civil war, by adhering to the king's cause, he consulted his safety by flight; but he returned at the restoration, was admitted an advocate in the court of arches, and succeeded Dr Exton as judge. When the queen-mother Henrietta died at Paris in 1669, her whole estate, real and personal, was claimed by her nephew Louis XIV.; upon which Dr Jenkins' opinion being called for and approved, he proceeded to Paris, accompanied by three others who were joined with him in a commission, and recovered her effects; a service for which he received the honour of knighthood. He officiated as one of the mediators at the treaty of Nimeguen, and was afterwards made a privy councillor and secretary of state. He died in 1685, and bequeathed his whole estate to charitable uses. Dr Jenkins was so great a benefactor to Jesus College, Oxford, that he is generally looked upon as the second founder. All his letters and papers were collected and printed in 1724, in two vols. folio.

JENTACULUM, among the Romans, a morning refreshment like our breakfast. It was exceedingly simple, consisting, for the most part, of bread alone; but labouring people had something more substantial, to enable them to support the fatigues of their employment. The Greeks distinguished this morning meal by the several names of *ἀριστον*, *ἀκρατισμος*, or *ἀκρατισμα*, though *ἀριστον* is generally applied to dinner.

JENYNS, Soame, a distinguished English writer, was born in Great Ormond Street, London, in the year 1704. Sir Roger Jenyns, his father, was descended from the family of the Jenyns of Churchill in Somersetshire. The country residence of Sir Roger was at Ely, in the isle of the same name, where he turned his attention to such kinds of business as rendered him most beneficial to his neighbours, and for his amiable deportment had the honour of knighthood conferred upon him by William III. His mother, a lady of rank, learning, and piety, superintended his education till it became necessary to place him under a tutor, by whom he was instructed in the rudiments of language, and such other branches of knowledge as were suited to his years.

In the year 1722, he was admitted into St John's College, Cambridge, under Dr Edmondson, who was at that time one of the leading tutors of the college. Here his diligence and regular deportment did him great honour, and the strict discipline observed in the college was perfectly agreeable to his natural inclinations. After quitting the college, he fixed his winter residence in London, but lived in the country during the summer season, being chiefly employed in the prosecution of studies of a literary kind. His first publication, a poetical essay on the art of dancing, appeared without his name in 1727; but he was soon discovered, and it was considered as a presage of his future eminence. Soon after the death of his father, he was, in 1742, chosen one of the members of parliament for the county of Cambridge; and from this period he retained his seat in the House of Commons until the year 1780. The high opinion entertained by his constituents, of his parliamentary conduct, may be learned from the unanimity of their choice; for he never experienced opposition but on one occasion. He was chosen one of the commissioners of the Board of Trade and Plantations in 1755, an office which he retained until an alteration was made in the constitution of it by authority of parliament. He was married, first, to the only daughter of Colonel Soame, of Dereham in Norfolk, who died without issue; and afterwards to the daughter of Mr Henry Gray, of Hackney, who survived him. He died of a fever, after a few days' illness, on the 18th of December 1787, leaving no issue. His temper was mild and gentle, and it was his earnest wish to avoid giving offence to any; yet he made such liberal allowances for diversities of temper, that he was very rarely offended with others. He was punctual in the discharge of the duties of religion, both in public and private; professing to be better pleased with the government and discipline of the church of England than of any other in Christendom, but at the same time considering these as capable of important alterations and amendments. He possessed a vein of lively and genuine wit, which he never made use of to wound the feelings of others, but was rather offended with those who did. He felt most sensibly for the miseries of others, and used every means in his power to relieve them. His indigent neighbours in the country he viewed as part of his family, and in this light he considered them as entitled to his care and protection. As an author, Soame Jenyns deserves a place amongst those who have excelled; and, as a writer of prose, he ranks with the purest and most correct of the English language. His first publication was his Free Inquiry into the Nature and Origin of Evil, on account of which he was severely censured; but, in a preface to the second edition, he vindicated it against all the strictures which had been made upon it, with that temper and moderation which so eminently distinguished him. His view of the Internal Evidences of the Christian Religion was published without his name in the year 1776; it gave delight and satisfaction to many eminent judges, and made converts of many who had previously been infidels. His works were published at London in 1790, in four vols. 8vo, with an account of his life by Mr Cole.

JEOFAILE (compounded of three French words, *J'ay faille,* I have failed), a term in law, used to indicate an oversight in pleading or other proceeding at law.

The showing of these defects or oversights was often practised by the counsel formerly; and when the jury came into court in order to try the issue, they said, This inquest you ought not to take; and after verdict they would say to the court, To judgment you ought not to go. But several statutes have been made to avoid the delays occasioned by such suggestions; and a judgment is not now to be stayed after verdict for a mistake in the Christian or surname of either of the parties, or in a sum of money, or in the day, month, year, &c. where the same are rightly named in any preceding record.

JEPHTHAH, judge of Israel, and successor to Jair in the government of the people, was a native of Mizpeh, and the son of one Gilead by a woman of indifferent reputation. This Gilead having married a lawful wife, and had children by her, drove Jephthah from his father's house, saying that he should not be heir with them. Jephthah retired into the land of Tob, and there became captain of a band of thieves. At that time the Israelites beyond Jordan, seeing themselves pressed by the Ammonites, came to desire assistance from Jephthah, and to request that he would take upon him the command. Jephthah at first reproached them with the injustice which they had done him, or at least which they had not prevented, when he was forced from his father's house. But as these people were earnest and pressing in their request, he told them that he would succour them, provided at the end of the war they would acknowledge him as their prince. This they consented to, and promised with an oath. Jephthah having thus been acknowledged prince of the Israelites in an assembly of the people, was filled with the spirit of God, and began to get his troops together; and for this purpose he travelled over all the land which the children of Israel possessed beyond Jordan. At the same time he made a vow to the Lord, that if he were successful against the Ammonites, he would offer up as a burnt-offering whatever should first come out of his house to meet him. The battle being fought, Jephthah proved victorious, and ravaged all the land of Ammon. But as he returned to his house, his only daughter came out to meet him, with timbrels and with dances; whereupon Jephthah tore his clothes, saying, "Alas, my daughter, thou hast brought me very low, for I have made a vow unto the Lord, and cannot fail in the performance of it." His daughter answered, "My father, if thou hast made a vow unto the Lord, do with me as thou hast promised; grant me only the favour that I may be at liberty to go up to the mountains, and there for two months bewail my virginity with my companions." Jephthah granted her this liberty; and at the expiration of two months he offered up his daughter as a burnt-offering, agreeably to his vow. Meanwhile, the Ephraimites, jealous of the victory obtained by Jephthah over the Ammonites, passed the river Jordan in a tumultuous manner, and complaining to Jephthah that he had not invited them to this war, threatened to set fire to his house. Jephthah answered them, that he had sent to desire their assistance; but observing that they did not come, he put his life in the hands of God, and hazarded a battle. The Ephraimites not being satisfied with these reasons, Jephthah assembled the people of Gilead, gave them battle, and defeated them; so that of the tribe of Ephraim there were forty-two thousand men killed on that day. We know nothing more concerning the life of Jephthah, except that he judged Israel during six years, and was buried in a city of Gilead.

JERBOA, a species of quadruped belonging to the genus *dipus*, and resembling, in some of its characters, the mouse tribe. See Mammalia.

JEREMIAH (*the Prophecy of*), a canonical book of the Old Testament. This divine writer was of the race of the priests, the son of Hilkiah of Anathoth, of the tribe of Benjamin. He was called to the prophetic office when very young, about the thirteenth year of Josiah, and continued in the discharge of it for about forty years. He was not carried captive to Babylon with the other Jews, but remained in Judæa to lament the desolation of his country. He was afterwards a prisoner in Egypt, with his disciple Baruch, where it is supposed he died at a very advanced age. Some of the Christian fathers tell us he was stoned to death by the Jews for preaching against their idolatry; and others say he was put to death by Pharaoh Hophrah, because of his prophecy against him. Part of the prophecy of Jeremiah relates to the time after the captivity of Israel and before that of Judah, and part of it was written in the time of the latter captivity. The prophet lays open the sins of Judah with great freedom and boldness, and reminds them of the severe judgments which had befallen the ten tribes for the same offences. He warmly laments their misfortune, and recommends to them a speedy reformation. Afterwards he predicts the grievous calamities which were approaching, particularly the seventy years captivity in Chaldæa. He also foretells their deliverance and happy return, and the recompense which Babylon, Moab, and other enemies of the Jews, should in due time meet with. There are likewise several intimations in this prophecy concerning the kingdom of the Messiah, and several remarkable visions, and types, and historical passages, relating to those times. St Jerome has observed respecting this prophet, that his style is more easy than that of Isaiah and Hosea; that he retains something of the rusticity of the place where he was born; but that he is very learned and majestic, and equal to those two prophets in the sense of his prophecy.

JERICHO, or Hierichus, in *Ancient Geography*, a city of Judæa, situated between Jordan and Jerusalem, at the distance of 150 stadia from the latter, and sixty from the former. Josephus says, "The whole space from Jerusalem is desert and rocky, and equally barren and uncultivated from Jericho to the Lake Asphaltites; yet the places near the town and above it are extremely fertile and delicious, so that it may justly be called a divine plain, surpassing the rest of the land of Canaan, no unfruitful country, and surrounded by hills in the manner of an amphitheatre. The place is now called *Raha*, and, according to Volney, is situated "in a plain six or seven leagues long by three wide, around which are a number of barren mountains, which render it extremely hot." Here was formerly cultivated the balm of Mecca. From the description of the Hadjis, this is a shrub similar to the pomegranate tree, with leaves like those of rue; it bears a pulpy nut, in which is contained a kernel that yields the resinous juice which we call *balm* or *balsam.* At present there is not a plant of it remaining at Raha; but another species is to be found there, called *zakkoun*, which produces a sweet oil, also celebrated for healing wounds. This zakkoun resembles a plum-tree; it has thorns four inches long, with leaves like those of the olive-tree, but greener, and more narrow, as well as prickly at the end; its fruit is a kind of acorn, without a calyx, under the bark of which is a pulp, and then a nut, the kernel of which gives out an oil that the Arabs sell very dear. This constitutes the sole commerce of Raha, which is no more than a ruinous village.

JEROME, St, in Latin *Hieronymus*, a celebrated doctor of the church, and the most learned of all the Latin fathers, was the son of Eusebius, and was born at Stridon, a city of the ancient Pannonia, about the year 340. He studied at Rome under Donatus, the learned grammarian. After having received baptism, he proceeded into Gaul, and there transcribed St Hilary's book *De Synodis*. He then went into Aquilcia, where he contracted a friendship with Heliodorus, who prevailed on him to travel with him into Thrace, Pontus, Bithynia, Galatia, and Cappadocia. In 372 St Jerome retired into a desert in Syria, where he was persecuted by the orthodox of Melitius's party for being a Sabellian, because he made use of the word *hypostasis*, which had been employed by the council of Rome in 369. This obliged him to go to Jerusalem, where he applied himself to the study of the Hebrew language, in order to acquire a more perfect knowledge of the Holy Scriptures; and about this time he consented to be ordained, on condition that he should not be confined to any particular church. In 381, he went to Constantinople to hear Gregory Nazianzen, and the following year returned to Rome, where he was made secretary to Pope Damasus. He then instructed many Roman ladies in piety and the knowledge of the sciences, which exposed him to the calumnies of those whom he zealously reproved for their irregularities; and Pope Siricius not having all the esteem for him to which his learning and virtue justly entitled him, this learned doctor left Rome, and returned to the monastery of Bethlehem, where he employed himself in writing against those whom he called heretics, especially Vigilantius and Jovinian. He had a quarrel with John of Jerusalem and Rufinus about the Origenists. St Jerome was the first who wrote against Pelagius. He died on the 30th of September 420, at about eighty years of age. There have been several editions of his works; the last, which is that of Verona, is in eleven vols. folio. His principal works are, 1. A Latin version of the Holy Scriptures, distinguished by the name of the *Vulgate;* 2. Commentaries on the Prophets, Ecclesiastes, St Matthew's Gospel, and the Epistles to the Galatians, Ephesians, Titus, and Philemon; 3. Polemical treatises against Montanus, Helvidius, Jovinian, Vigilantius, and Pelagius; 4. Letters; 5. A treatise on the lives and writings of the ecclesiastical authors who had flourished before his time. The style of St Jerome is lively and animated, sometimes rising to the sublime.

Jerome *of Prague*, so called from the place of his birth in Bohemia. He was neither a monk nor a clergyman, but had received a learned education. Having embraced the opinions of John Huss, he began to propagate them in the year 1480. In the mean time the council of Nice kept a watchful eye over him, and, considering him as a dangerous person, cited him to appear before them and give an account of his faith. In obedience to this citation, he went to Constance; but on his arrival, in 1415, finding Huss in prison, he set out for his own country. Being seized on the way, imprisoned, and examined, however, he was so intimidated that he retracted, and pretended to approve of the condemnation of the opinions of Wickliff and Huss. But he recanted his retractation, which, on the 26th of May 1416, he condemned in these terms: "I am not ashamed to confess here publicly my weakness. Yes, with horror I confess my base cowardice. It was only the dread of the punishment by fire which drew me to consent, against my conscience, to the condemnation of the doctrine of Wickliff and Huss." Accordingly sentence was passed on him, in pursuance of which he was delivered to the secular arm, and burned, in 1416. He was a person of great parts, learning, and elocution.

JERONYMITES, Hieronymites, a denomination given to various orders or congregations of religious persons, otherwise called *Hermits of St Jerome*.

JERSEY, one of a group of islands, forming part of the ancient duchy of Normandy, but now considered as a portion of the county of Hampshire in England, for some few legal purposes. It is about six leagues from the French, and twenty-three from the English coast. It is nearly twelve miles in length from east to west, and in no part more than seven miles in breadth. The square extent is sixty-three miles, or about 40,000 English acres. The shore is indented with numerous bays; but they are very difficult of access, from the rapidity of the tide, which, among the rocks that surround the island, causes eddies of great but variable velocity. The island is protected by appropriate fortifications, and in time of war is commonly provided with a sufficient military force, besides a well-disciplined militia, to defend it from sudden attacks. The face of the island is rather hilly, with rich, well-watered valleys between the respective ranges; the slope is towards the south; and, though the tops of the hills are almost barren, yet the soil in the lower parts is a rich and well-cultivated alluvium. The climate is mild and uniform, frosts being rare in winter, and the air being tempered by the sea-breezes in the summer. Though fertile, the island does not grow sufficient corn for the sustenance of the dense population; but it yields a surplus of fruit, of cider, and of potatoes; and, besides, sends yearly to England some hundreds of the peculiar race of cows which, like those of Guernsey and Alderney, are esteemed for the great quantity rather than the good quality of the milk which they yield. The chief trade of the island is the Newfoundland fishery, for which several ships are equipped and annually despatched. Formerly a great contraband trade was carried on; and in time of war the business of privateering was extensively followed. The island is governed by a local legislature and a distinct judicature, under the ultimate control of the king in council. The ancient Norman laws are still in force, and the greater part of the inhabitants retain, and among themselves use, the language of the country from which they originated. The church of England is the established religion, and is under the ecclesiastical direction of the Bishop of Winchester. There are several of the other protestant sects, who support their own religious institutions. Though easily defended as long as England has a superior naval force to succour it, Jersey has always been deemed a desirable possession by France. Several attacks have been projected, and one actually made in 1781, which was at first successful, but ultimately repelled by a body of troops under the brave Major Pierson, who was unfortunately killed in the action. In an attempt two years before, the French were intercepted by an English squadron, and destroyed before they could land any troops. The chief town is St Hilliers; another town, St Aubins, is smaller; both the harbours are dry at low water. The population amounts to upwards of 29,000, being the most dense of any in the British dominions.

JERSEY, New, one of the thirteen original states of the American union, is bounded on the north and north-east by New York, on the east and south-east by the Atlantic Ocean, on the south-west by Delaware Bay, and on the west by Pennsylvania. The extreme length directly from north to south is one hundred and seventy miles, the mean breadth is about forty-six miles, and the whole state contains an area of 7820 square miles.

The surface of the country presents every variety, but three marked divisions may be particularised; first, a sandy or marine section; secondly, a hilly or middle section; and, thirdly, a mountainous section. The first occupies nearly one half of the area of the state. A line from the mouth of Shrewsbury River to Bordentown will very nearly separate the alluvial from the hilly region. Between this limit and the continuation of the blue ridge, the state is beautifully variegated by rich and bold scenery. From the north to the south a succession of mountains, and lesser hills and heights, interspersed with plains, stretch out, each occupying a distinct and well-defined region. The mountainous portion of New Jersey is the extreme northern part of the state, composed of the counties of Warren and

Sussex. The elevation of the different sections has not been very accurately determined, but the higher valleys of the latter county must be from 800 to 1000 feet above the level of the sea. The descent from the mountain to the hilly region is abrupt, as by the steps of a stair. A remarkable difference of temperature is experienced in the space of less than two and a half degrees of latitude. The alluvial plains of the southern section have a mild or rather tropical climate, resembling the eastern part of Virginia, and admit of the cultivation of cotton; whilst in the counties of Sussex and Warren it is more various, and, though salubrious enough, is in general less mild.

The principal internal waters are Second River, Hackinsack, Passaic, Raritan, Musconetcong, Rancocus, Salem, Shrewsbury, Tom's River, Great Eggharbor, Cohanzey, and Maurice River. None of these rivers are of any great length, though every part of the state abounds in rapid mill-streams. A connexion, by means of a canal, between the Hudson and Delaware basins was completed in 1831, at an expense of about 2,000,000 of dollars. The line leaves the Delaware at Phillipsburgh, opposite Easton in Pennsylvania, and is carried over Warren county, New Jersey, to its extreme north-east angle, about thirty miles; thence eastward through Morris and Essex counties, to the Passaic River, and along the valley of the latter to Newark. From that city it proceeds across Passaic and Hackinsack, and winds through the Bergen Marshes to Jersey city, opposite New York. Inclined planes are used on this canal instead of locks. During the year 1834 the Delaware and Raritan Rivers were connected by means of a canal from Brunswick to Bordentown, a distance of above thirty miles. This canal is calculated for sloop navigation; and has been constructed at an expense, with its feeder, of 2,500,000 dollars. The principal railroad is the Camden and Amboy, which unites the cities of New York and Philadelphia, crossing the state of New Jersey. It is sixty-one miles in length, and is connected with the Raritan and Delaware Canal. There is likewise a road from the manufacturing village of Patterson to New York, a distance of about sixteen miles; and another in progress (1835) from Jersey city, through Newark and Elizabethtown, to Brunswick.

New Jersey abounds in staples, composed of every product of its fields, woods, mines, fisheries, and manufactories. Some parts of the state are not well adapted to cultivation, being either sandy and barren, or rocky and mountainous; but large portions have a soil of great fertility, well suited to the cultivation of grain, and fitted for grazing; and accordingly vast numbers of cattle are raised for the markets of New York and Philadelphia. Large quantities of butter and cheese, of superior quality, are made; and apples, peaches, and fruits of all kinds, are raised in abundance. The manufactories of New Jersey are extensive and thriving. Iron is probably the most important. Bog ore is found in Burlington and Monmouth, and the mines of the northern counties are exceedingly rich. There are a number of forges and furnaces in active operation in several of the counties, and chain-cables are made at the town of Dover. The towns most engaged in manufactures are Newark and Patterson. The former is noted for the manufacture of leather, and the exercise of various occupations in which it is employed; also for the making of carriages, cabinet ware, and fancy chairs. Patterson is chiefly noted for its manufactures of cotton, hemp, and machinery. Glass of various kinds, and in large quantities, is made in different counties; and paper and gunpowder are manufactured to some extent. This state is rich in mineral productions. Besides the iron already mentioned, which is abundant, limestone prevails extensively. Marble and zinc are found, and ores of gold and silver have been discovered. Copper mines in Somerset and Bergen counties were wrought previously to the revolution, and extensive veins are believed to cross the state in a south-westerly direction, from Schuyler mine, near Belleville, to the river Delaware. Marl, well adapted for manuring the arenaceous districts, is found in their vicinage. Clay of superior quality for the arts is obtained in great abundance near South Amboy; and sand, adapted for the manufacture of the finest glass, is found in the county of Cumberland, from which it is conveyed to the principal manufactories of the union.

New Jersey is divided into fourteen counties, Bergen, Morris, Sussex, Warren, Essex, Somerset, Henderson, Middlesex, Burlington, Monmouth, Gloucester, Salem, Cumberland, and Cape May; and these are subdivided into townships. Trenton, the seat of government, is on the Delaware River, at the falls, on the great route between New York and Philadelphia, sixty miles south-west of the former, and thirty north-east of the latter. At the foot of the falls there is an elegant bridge over the Delaware, and that river is navigable for sloops and steam-boats to this place. The latter ply regularly between Trenton and Philadelphia. It is a handsome town, and contains a number of public buildings, amongst which the most conspicuous is the state-house. Trenton contains several respectable manufactories; and, in 1830, the population amounted to 3925. Newark is pleasantly situated on the western bank of the Passaic River, a few miles from its mouth. This is the handsomest town in the state, and contains several public buildings and religious edifices, together with extensive manufactories of different kinds. In this and the adjoining town of Orange there are valuable quarries of stone for building, and numerous tanneries. The population in 1830 amounted to 10,953. New Brunswick is situated on the western bank of the Raritan, thirty-three miles south-west of New York; and steam-boats regularly ply between the two cities. The buildings of New Brunswick, which has a city incorporation, are thinly distributed over a considerable extent of ground. Besides several public buildings and churches, there is a college and theological seminary. The former was established by the ministers of the Dutch reformed church, for the education of their clergy, and incorporated in 1770. The exercises, which were suspended for several years, were revived in 1825, under very favourable auspices. The theological seminary was established in the city in 1810, by the general synod of the Dutch reformed churches, and is to a certain extent connected with the college. In 1830, the population of New Brunswick amounted to 7831, half of whom are of Dutch extraction. Princeton is a pleasant village, eleven miles north-east of Trenton, and sixteen south-west of Brunswick. Here is the college of New Jersey, founded in 1738, and which has always been one of the most respectable and flourishing literary institutions in the country. The college edifice is designated Nassau Hall, and it contains a chapel, with sixty rooms for students. There are also buildings for the library, philosophical apparatus, museum, and other purposes. There are ten instructors, and above one hundred students. There is also a theological seminary at Princeton, connected with which are two professors, one of didactic and polemic theology, and another of ecclesiastical history. The edifice for the accommodation of the institution is an elegant stone building, containing rooms for one hundred students. Elizabethtown is pleasantly situated on Elizabethtown Creek, which empties itself into Staten Island Sound. Vessels of twenty or thirty tons come up to the town, and those of two or three hundred tons to within two miles of the town. A steam-boat plies between the city of New York and Elizabethtown Point. Patterson is situated on the Passaic, near the great falls, in a position much admired for the romantic scenery which surrounds it. It is the chief manufacturing town in the

Jerusalem. state, and in 1830 contained a population of 7731. The other towns are not of sufficient importance to demand individual description. They have all, according to their size, the usual number of public edifices and of religious houses.

Great attention to the cause of public education has recently been evinced throughout this state, and measures adopted which promise important results to the cause of universal enlightenment. Previously to the inquiry which was instituted in 1828, the system of instruction was very defective; but efforts have since been made to change this state of things. A school fund, exceeding 250,000 dollars, is managed by trustees under the authority of the legislature, and is steadily increasing; whilst a large portion of its annual income is distributed amongst the several townships, and is applied, augmented by moneys voluntarily raised by the townships, to the support of common schools, and otherwise to extend the means of education over the whole community. With regard to religion, almost every Christian denomination is represented in this state. The Presbyterians have eighty-five churches, eighty-eight ministers, twenty licentiates, and 12,519 communicants; the methodists 10,730 members; the Dutch reformed churches are twenty-eight in number, with as many ministers; the Baptists have thirty-four churches, twenty-one ministers, and 2324 communicants; the Episcopalians twenty ministers; the Friends are numerous; and there are some Congregationalists.

The legislature is composed of two bodies; the legislative council and the general assembly. The former is composed of fourteen members, one being returned from each county; and the latter of fifty members, the counties being represented by different numbers, from one to five. The governor is annually appointed, and, like most of the executive, judicial, and military officers, by the two houses in joint meeting. The judicial powers are, a court of chancery, modelled after that in England, the governor being chancellor; a supreme court of common law jurisdiction over the whole state, with a circuit court for the trial of issues of fact in civil cases in each county; courts of common pleas in the several counties, for the trial of civil causes; orphans' courts, for matters of testament, administration, and guardianship; and courts with presiding justices of peace, for the trial of small causes. The courts of criminal jurisdiction are, courts of general sessions of the peace, of oyer and terminer and general jail delivery, the supreme court, and the governor and council for the trial of impeachments exhibited by the house of assembly. According to the official documents of 1830, the military force of the state consists of 30,456 infantry, 1810 cavalry, 1886 artillery, 1115 riflemen, and 93 general, brigade, and staff officers, forming in all a body of 35,360 men.

The counties of Salem and Bergen in this state were respectively very early settled by the Swedes and Dutch, the latter people having emigrated from the neighbouring settlement of New York. By a charter dated in 1664, Charles II. granted this province to his brother James duke of York, who, having shortly afterwards granted it to subordinate agents, the English were not tardy in extending the settlement. In 1676, it was separated into two great divisions, East Jersey and West Jersey. Each owned a separate proprietor, who held both the rights of the soil and the powers of government; governors being appointed by them for the exercise of the latter, whilst the people were allowed to elect their own representatives. In 1702, the powers of government passed from the hands of the proprietors into those of Queen Anne, and the colony remained attached to the British crown until the declaration of American independence. During this period the governors were nominated by the crown, and the legislature, as before, chosen by the people, but afterwards representing the whole community, and sitting alternately at Burlington and Perth Amboy, then the principal towns of the respective divisions. From the earliest period of its history, New Jersey displayed much zeal and firmness in the cause of civil and religious liberty, and was amongst the earliest to resolve on independence. During the revolutionary conflict, it suffered much from having been the arena where the belligerent hosts frequently contended; and some of the most interesting scenes and the most arduous conflicts took place within its limits. This state has the two large and increasing cities of New York and Philadelphia on its borders; and, viewed in every light, although much smaller than many others in the union, it may be doubted whether it is not the most advantageously situated of any political subdivision in the republic. The population in 1820 was 277,575, and in 1830, 320,779; of these, 2446 were slaves. (R. R. R.)

JERUSALEM.

Jerusalem, one of the most ancient and renowned cities of which we have any account, formerly the capital of the Jewish empire, and now that of modern Palestine. It is situated on unequal ground, on a range of high hills, some few eminences of which overtop those on which the city stands, and the adjacent country is remarkably rocky and barren. The city, which is surrounded with a wall fifty feet in height, occupies an irregular square, facing the four cardinal points, and is about two and a half miles in circumference. The eastern wall, which is not quite so long as the other sides, runs straight along the brow of Mount Moriah, with the deep valley of Jehoshaphat below. The southern side is extremely irregular, taking a zigzag direction; the south-west extreme being terminated by a mosque built over the supposed sepulchre of David, on the summit of Mount Zion. The southern wall is quite straight and regular, and runs over slightly-declining ground. The side facing the west is the longest of the whole. The wall appears to be a modern work, all executed at the same time. It is flanked at irregular distances by square towers, and is guarded by battlements all around, with loop-holes for arrows or musketry. On the north the city is bounded by a level and apparently fertile space, covered with olive trees, particularly near the north-eastern angle. On the south is seen the steep acclivity of Mount Zion, and the Valley of Hinnom, on which are some cultivated spots and small garden enclosures. On the west the sterile summits of the hills scarcely rise above the dwellings; whilst eastward, the deep valley of Jehoshaphat, at the foot of the Mount of Olives, though partially relieved by spots with trees, presents, in general, a forbidding and barren appearance. The first aspect of Jerusalem has been variously described by different writers, and the city appears to be seen to more or less advantage according to the quarter from which it is approached. Dr Clarke was impressed with its grandeur when he first obtained a distant prospect of it. "Instead," he observes, "of a wretched and ruined town, by some described as the desolated remnant of Jerusalem, we beheld as it were a flourishing and stately metropolis, presenting a magnificent assemblage of domes, towers, palaces, churches, and monasteries, all of which, glittering in the sun's rays, shone with inconceivable splendour." "I can now account," says Chateaubriand, "for the surprise expressed by the crusaders and pilgrims at the first sight of Jerusalem, according to the reports of historians and travellers. I can affirm, that whoever has, like me, had the patience to read nearly two hundred modern accounts of the Holy Land, the rabbinical compilations, and the passages in the ancient writers, respecting Judæa, still knows nothing at all about it. I paused with my eyes fixed on Jerusalem, measuring the height of its walls, reviewing at once all the recollections of history from the patriarch Abraham to Godfrey of Bouillon, reflecting on the total change accomplished in the world by the mission of the Son of Man, and in vain seeking that temple, not one stone of which is left upon another. Were I to live a thousand years, never should I forget that desert, which yet seems to be pervaded by the greatness of Jehovah, and the terrors of death."[1] Dr Clarke, however, observes that there is another point from which Jerusalem is not seen to so much advantage; and accordingly Mr Browne, who approached it by the road from Jaffa, observes, that the first aspect of Jerusalem did not gratify his expectation; and Buckingham declares, that, independently of the feelings and recollections which the approach to this city cannot fail to awaken, its appearance disappointed his expectations, and "had certainly nothing of grandeur or beauty, of stateliness or magnificence, about it. It appeared like a walled town of the third or fourth class, having neither towers, nor domes, nor minarets within it; but strong, large, flat-roofed buildings, of the most unornamented kind, seated amid rugged hills, on a stony and forbidding soil, with scarcely a picturesque object in the whole compass of the surrounding view."[2] In like manner Sir Frederick Henniker asks, "Is this the city that men call the perfection of beauty and the joy of the whole earth? The town, which appears to me not worth possession, even without the trouble of conquest, is walled entirely round, is about a mile in length and half a mile in width, so that its circumference may be estimated at three miles. In three quarters of an hour I performed the circuit. It would be difficult to conceive how it could ever have been larger than it now is; for, independent of the ravines, the four outsides of the city are marked by the brook of Siloam, by a burial-place at either end, and by the hill of Calvary; and the hill of Calvary is now within the town, so that it was formerly smaller than it is at present. The best view of it is from the Mount of Olives; it commands the exact shape, and nearly every particular, namely, the church of the Holy Sepulchre, the Armenian convent, the mosque of Omar, St Stephen's Gate, the round topped houses, and the barren vacancies of the city. The mosque of Omar is the St Peter's of Turkey. The building itself has a light pagoda appearance; the garden in which it stands occupies a considerable part of the city, and, contrasted with the surrounding desert, is beautiful; but it is forbidden ground, and Jew or Christian entering within its precincts must, if discovered, forfeit either his religion or his life."[3] The diversity of opinion, nay, even the apparent contradiction, which prevails in the accounts of different travellers respecting Jerusalem, will be still further illustrated by M. de Lamartine's description of the exterior aspects of the holy city.

"This city," says he, "is not, as it has been represented, an unshapely and confused mass of ruins and ashes, over which a few Arab cottages are thrown, or a few Bedouin tents pitched; neither is it, like Athens, a chaos of dust and crumbling walls, where the traveller seeks in vain the shadow of edifices, the trace of streets, the phantom of a city; but it is a city shining in light and colour, presenting nobly to view her intact and battlemented walls, her blue mosque with its white colonnades, her thousand resplendent domes, from which the rays of the autumnal sun are reflected in a dazzling vapour; the façades of her houses, tinted by time and heat, of the yellow and golden hue of the edifices of Pæstum or of Rome; her old towers the guardians of her walls, to which neither one stone, one loop-hole, nor one battlement is wanting; and, above all, amidst that ocean of houses, that cloud of little domes which cover them, is a dark elliptical dome, larger than the others, overlooked by another and a white one. These are the churches of the Holy Sepulchre and of Calvary; from hence they are confounded, and appear drowned in the immense labyrinth of domes, edifices, and streets, which encompass them; and one finds it difficult to credit such a situation for Calvary and the Sepulchre, which, according to the ideas we derive from the gospel history, should be placed on a separate hill without the walls, and not in the centre of Jerusalem. The city, confined on the side of Mount Sion, has no doubt enlarged herself on the north, to embrace within her circuit those two sites which make her shame and glory, that of the murder of the just man, and the resurrection of the incarnate Deity.

"Such is the city from the height of the Mount of Olives. She has no horizon behind her to the west nor to the north. The line of her walls and her towers, the points of her numerous minarets, the arches of her shining domes, stand out in bold relief against the deep blue of an orient sky; and the town, thus exhibited on its broad and elevated platform, seems again to shine in all the antique splendour of its prophecies, or to be only waiting the word to rise in dazzling glory from its seventeen successive ruins, and to be transformed into that New Jerusalem which is to come out of the bosom of the desert radiant with brightness.

"The view is the most splendid that can be presented to the eye, of a city that is no more; for she still seems to exist as one full of life and youth: but on contemplating the scene with more attention, we feel that it is really no more than a fair vision of the city of David and Solomon. No noise arises from her squares and streets, no roads lead to her gates from the east or from the west, from the north or from the south, except a few paths winding among the rocks, on which you may meet only half-naked Arabs, some camel drivers from Damascus, or women from Bethlehem or Jericho, carrying on their heads a basket of raisins from Engaddi, or a cage of doves, to be sold on the morrow under the trebinthuses beyond the city gates. No one passed in or out; no mendicant even was seated against her curbstones; no sentinel showed himself at her threshold; we saw, indeed, no living object, heard no living sound; we found the same void, the same silence, at the entrance of a city containing 30,000 souls, during the twelve hours of the day, as we should have expected before the gates of Pompeii or Herculaneum.

"We saw nothing pass the gate of Damascus, except four funeral processions, silently winding their way along the walls to the Turkish cemetery; nor the gate of Sion, while we were within view, except a poor Christian, who had died in the morning of the plague, and was carried by four grave-diggers to the Grecian burial-place. They passed close by us, stretched the infectious corpse upon the ground, wrapped in its own garments, and in silence commenced digging its last bed under our horses' feet. The earth all around the city was freshly disturbed by similar sepultures, which the plague multiplied daily; and the only sensible noise outside the walls of Jerusalem was the monotonous plaints of the Turkish women bewailing their dead. I know not whether the plague was the only cause of the emptiness of the roads and the profound silence that reign-

[1] *Itinéraire de Paris à Jerusalem*, tom. xxii. p. 385.
[2] *Travels through Palestine*, p. 174.
[3] *Notes on Egypt, &c.*

Jerusalem. ed within and around Jerusalem, but I think not; for the Turks and Arabs turn not away from the inflictions of Omnipotence, which they are convinced may everywhere reach them, and that there is no road by which to escape; a sublime idea, but which often leads to the most fatal consequences.

"To the left of the platform, the temple, and the walls of Jerusalem, the hill which supports the city suddenly sinks, stretches itself, and descends in gentle slopes, sometimes broken by terraces of falling stones. On its summit, at some hundred paces from Jerusalem, stand a mosque, and a group of Turkish edifices, not unlike a European hamlet, crowned with its church and steeple. This is Sion, the palace, the tomb of David; the seat of his inspiration and of his joys, of his life and his repose. A spot doubly sacred to me, who have so often felt my heart touched and my thoughts rapt by the sweet singer of Israel,—the first poet of sentiment,—the king of lyrics. Never have human fibres vibrated to harmonies so deep, so penetrating, so solemn. Never has the imagination of poet been set so high, never has its expression been so true. Never has the soul of man expanded itself before man, and before God, in tones and sentiments so tender, so sympathetic, and so heartfelt. All the most secret murmurs of the human heart found their voice and their note on the lips and the harp of this minstrel. And if we revert to the remote period when such chaunts were first echoed on the earth; if we consider that at the same period the lyric poetry of the most cultivated nations sang only of wine, love, war, and the victories of the muses, or of the coursers at the Elcian games; we dwell with profound astonishment on the mystic accents of the prophet king, who addresses God the Creator as friend talks to friend; comprehends and adores His wonders, admires His judgments, implores His mercies, and seems to be an anticipatory echo of the evangelic poetry, repeating the mild accents of Christ before they had been heard. Prophet or not, as he is contemplated by the philosopher or the Christian, neither of them can deny the poet king an inspiration bestowed on no other man. Read Horace or Pindar after a psalm! For my part I cannot.

"I, the feeble poet of an age of silence and decay, had I domesticated at Jerusalem, should have selected for my residence and abiding place precisely the spot which David chose for his at Sion. Here is the most beautiful view in all Judæa, Palestine, or Galilee. To the left lies Jerusalem with its temple and its edifices, over which the eyes of the king or of the poet might rove at large without his being seen from thence. Before him, fertile gardens, descending in steep declivities, lead to the bed of that torrent, in the roar and foam of which he delights. Lower down, the valley opens and extends itself; fig-trees, pomegranates, and olives, overshadowing it. On one of these rocks, suspended over the rolling tide; in one of these sonorous grottoes, refreshed by the breeze and by the murmur of the waters; or at the foot of a trebinthus, ancestor of that which shelters me; the divine poet doubtless awaited those inspirations which he so melodiously poured forth. And why will they not here also visit me, that I might recount in song the griefs of my heart, and of the hearts of all men, in these days of perplexity, even as he sang of his hopes in an era of youth and of faith? Song, alas, no longer survives in the heart of man, for despair sings not. And until some new beam shall descend upon the obscurity of our times, terrestrial lyres will remain mute, and mankind will pass in silence from one abyss of doubt to another, having neither loved, nor prayed, nor sang.

"But to return to the palace of David. Here the eye rests upon the once verdant and watered valley of Jehoshaphat; a large opening in the eastern hills conducts it from steep to steep, from height to height, from undulation to undulation, even to the bason of the Dead Sea, which, in the far distance, reflects the evening sun-beams in its dull and heavy waters, giving, like the thick Venetian crystal, an unpolished and leaden tint to the light which gleams upon it. This sea is not, however, what the imagination may picture it, a petrified lake, amidst a dull and colourless horizon. It resembles one of the most beautiful lakes of Switzerland or Italy as it is seen from hence, reposing its tranquil waters beneath the shadow of the lofty mountains of Arabia (which stretch like the Alps as far as the eye can reach behind its waves), and amidst the projecting, pyramidical, conical, unequal, jagged, and sparkling ridges of the most distant mountains of Judæa. Such is the view from Sion. We will now proceed.

"There is another feature in the landscape of Jerusalem, which I could wish to have indelibly engraven on my memory, although I neither draw nor paint. It is the valley of Jehoshaphat. That valley, celebrated in the traditions of three religions, in which Jews, Christians, and Mahommedans unite to place the terrible arena of Supreme judgment. That valley which has already witnessed on its confines the grandest scene of the evangelical drama; the tears, the groans, and the death of Christ. That valley which all the prophets have successively visited, sending forth a cry of bitterness and horror, with which it seems still to vibrate. That valley through which shall one day pour the awful sound of a torrent of souls about to present themselves before their God for final judgment."[1]

What follows is part of an interior view of the holy city by the same gifted writer, and it appears to us to be instinct with devout feeling and high genius.

"Having walked down some other streets similar to those I have already described, we found ourselves in a little square, open at the north to a point of the heavens and to the Mount of Olives. A descent of a few steps to the left brought us to an open court, in which the *façade* of the church of the Holy Sepulchre was displayed. This church has been so often and so well described, that it is needless for me to enter upon the subject anew. It forms, especially in its exterior, a vast and beautiful monument of the Byzantine age; its architecture is severe, solemn, grand, and rich, for the period in which it was built; and it is a temple worthy of being erected, by the piety of man, over the tomb of the Son of Man. In comparing this church with others which the same epoch produced, it will be found superior to them all. St Sophia, much more colossal, is also much ruder in its structure; outwardly it is but a mountain of stone, flanked by little hills of stone. The Holy Sepulchre, on the contrary, presents an aerial and carved cupola; its scientific and graceful figure, with its doors, its windows, its capitals and cornices, displays, in addition to its massiveness, the incalculable cost of that ingenious fret-work, by which stone seems converted into lace, to render it worthy of a place in this monument erected to the grandest of human conceptions; and it bears impressed, no less on its details than on its aggregate effect, the idea to which it is dedicated. It is no longer, indeed, that church of the Holy Sepulchre constructed by Saint Helena, the mother of Constantine; the kings of Jerusalem successively retouched it, and embellished it with architectural ornaments in that half western, half Moorish style, of which the East furnished them both with the taste and with the models. But, such as it now stands, the exterior, in its Byzantine mass, its Greek, Gothic, and Arabesque decorations—even its fractures, the impress of time

[1] *Pilgrimage to the Holy Land*, vol. ii. p. 15-20, English translation, London, 1835.

 and barbarism upon its *façade*—offers no revolting contrast to the thoughts we bring to it, the thoughts it expresses. Its aspect excites no painful perception of a grand idea inadequately represented; of an exalting reminiscence profaned by the hand of man: on the contrary, the involuntary feeling inspired by it equals what I expected; man has done his best. The monument is not worthy of the tomb, but it is worthy of the human agents whose wish has been to do honour to this illustrious sepulchre; and we enter the vaulted and sombre vestibule of the nave under the influence of this first and serious impression.

"On the left of the entrance to the vestibule, which opens upon the same court as the nave, in a large deeply-hollowed niche, the Turks, the present guardians of the Holy Sepulchre, to whom belongs exclusively the privilege of opening or closing it, have established their divan, which is covered with rich Aleppo carpets; and there, when I passed, were squatted five or six venerable Turkish figures, with long white beards, their coffee-cups and pipes placed before them on the carpet. They saluted us with dignity and grace, and ordered one of the superintendents to accompany us to all parts of the church. I saw no trace in their countenances, their discourse, or their gestures, of the irreverence of which they are accused. They do not enter the church, but content themselves outside its doors, and address Christians with a seriousness and respect becoming the place and the object of visiting it. Possessors, by the vicissitude of war, of the sacred monument of the Christians, they do not destroy it and cast its ashes to the winds; they preserve it, they maintain around it an order, a police, a reverential silence, which the Christian communities, who contend for it, are far from observing themselves. They watch over the preservation of a relic common to all who bear the name of Christians, for the benefit of all, that every communion may enjoy in its turn the worship which all would gladly offer at the holy tomb. But for the Turks, that tomb, disputed by the Greeks, the Catholics, and the innumerable ramifications of the Christian world, would already have been a hundred times an object of strife between those rival and hostile communities; would have passed alternately into the exclusive possession of either party, and have been interdicted doubtless by each, during their hour of triumph, to all professors of the common faith who come not within their own pale. I see no justice in the calumnies heaped upon the Turks; the pretended brutal intolerance with which they are charged was manifested to my observation only in respect for what other men venerate and adore. Wherever a Mussulman sees the image of God in the opinions of his fellow-creatures, he bows down and he respects, persuaded that the intention sanctifies the form. They are the only tolerant people. Let Christians examine themselves, and ask in sincerity how they would have acted if the fortune of war had placed Mecca and Kaaba in their hands. Would the Turks then resort thither from all parts of Europe and of Asia, to revere, in peace, the carefully preserved monuments of Islamism?

"At the end of the vestibule we stood under the large cupola of the church, the centre of which, deemed by local tradition the centre of the earth, is occupied by a small monument enclosed within a larger, as a precious stone is enchased in other minerals. It is an oblong square, adorned with pilasters, a cornice, and a cupola, all of marble; the whole of a laboured and eccentric design, and executed in bad taste. It was rebuilt in 1817, by an European architect, at the expense of the Greek church, now in possession of it. All around this interior pavilion of the sepulchre extends the space of the external cupola, within which we walk freely, and find in the intervals between the piers chapels of great depth, each assigned to one of the mysteries of Christ's passion, and all containing some testimonies, real or supposed, of the scenes of the redemption. That part of the church which is not under the cupola is divided from it by a partition of painted wood, hung with pictures of the Greek school, and is exclusively reserved for the schismatic Greeks. In spite of the singular profusion of bad paintings and ornaments of every description, with which the walls and altars are overloaded, the general effect is solemn and religious, conveying the assurance that prayer under every form has taken possession of this sanctuary, and that pious zeal has accumulated within it every object which generations of superstitious but sincere worshippers have deemed precious in the sight of God. From hence a flight of steps, cut in the rock, conducts to the summit of Calvary, where the three crosses were posted; so that Calvary, the tomb, and several other sites of the drama of redemption, are united under the roof of a single edifice of moderate dimensions; a circumstance that appears but ill to accord with the gospel histories. We are not prepared by them to find the tomb of Joseph of Arimathea, which was cut in the rock, outside the walls of Sion, fifty paces from Calvary, the scene of executions, and enclosed within the circumference of the modern walls; but such is tradition, and it has prevailed. The mind cannot dispute over a scene like this the difference of a few paces between historical probability and tradition. Whether it were here or there, it is certain the events occurred at no great distance from the points marked out. After a few moments of deep and silent meditation devoted in each of these sacred spots to the remembrances awakened, we re-descended to the body of the church, and penetrated within the interior monument, which serves as a sort of stone curtain or envelope to the sepulchre itself. This is divided into two small sanctuaries; the first containing the stone on which the angels were seated when they answered the holy women, "*He is not here, he is risen;*" the second and last sanctuary enclosing the sepulchre itself, but covered with a sort of sarcophagus of white marble, which surrounds and entirely conceals from the eye the actual substance of the primitive rock in which the sepulchre was cut. This sacred chapel is lighted by lamps of gold and silver, perpetually maintained; and perfumed incense is burnt there night and day, warming and embalming the air. We suffered none of the temple officials to penetrate it with us, but entered one by one, separated by a curtain of crimson silk from the first sanctuary; we chose that no witness should disturb the solemnity of the place, and the privacy of the impressions each might experience according to his individual notions, and the measure and nature of his faith in the great event which the tomb commemorates. We staid each about a quarter of an hour, and none of us left it with dry eyes. Whatever form religious sentiments may have assumed in the soul of man; whether influenced by private meditation, by the study of history, by years, or the vicissitudes of the heart and mind; whether he have retained Christianity in its literal interpretation, and in the doctrines imbibed from his parents, or is only a philosophical and spiritual Christian; whether Christ be to him a crucified God, or no more than a holy man deified by virtue, inspired by supreme truth, and dying to bear testimony to his father; whether Jesus be in his eyes the Son of God or the Son of Man, divinity incarnate or humanity deified; Christianity is still the religion of his memory, of his heart, and of his imagination; and will not have so wholly evaporated before the winds of time and life as that the soul on which it was shed shall preserve no vestige of its primitive odour, or that its fading impressions can resist the revivifying and awfully affecting influence of its birth-place, and of the visible monuments of its earliest profession. To the Christian or to the philosopher, to the moralist or to the historian, this tomb is the boundary of two worlds, the ancient and the modern. From this point issued a truth that has renewed the universe; a civilization that has transformed all things; a word which has echoed over the whole globe. This tomb is the sepulchre of the old world, the cradle of the new; never was earthly stone the foundation of so vast an edifice; never was tomb so prolific; never did doctrine, inhumed for three days or three centuries, so victoriously rend the rock which man had sealed over it, and give the lie to death by so transcendent, so perpetual a resurrection.

"In my turn, and the last, I entered the Holy Sepulchre, my mind filled with these stupendous reflections, my heart touched by impressions yet more sacred, which remain a mystery between man and his soul, between the reasoning insect and his Creator. Such impressions admit not of words; they exhale with the smoke of the holy lamps, with the perfume of the censers, with the vague and confused murmur of sighs; they fall with those tears that spring to the eyes from remembrance of the first names we have lisped in infancy—of the father and the mother who inculcated them—of the brothers, the sisters, the friends with whom we have whispered them. All the pious emotions which have affected our souls in every period of life; all the prayers that have been breathed from our hearts and our lips in the name of him who taught us to pray to his Father and to ours; all the joys and griefs of which those prayers were the interpreters; are awakened in the depths of the soul, and produce, by their echoes, by their very confusion, a bewildering of the understanding, and a melting of the heart, which seek not language, but transpire in moistened eyes, a heaving breast, a prostrate forehead, and lips glued in silence to the sepulchral stone. Long did I remain in this posture, supplicating the Father of heaven, in that very spot from whence the most pathetic and comprehensive of prayers ascended for the first time to his throne; praying for my father here below, for my mother in another world, for all those who live or are no more, but our invisible link with whom is never dissolved: the communion of love always exists: the names of all the beings I have known and loved, or by whom I have been beloved, passed my lips on the stones of the Holy Sepulchre. I prayed last for myself, but ardently and devoutly. Before the tomb of him who brought the greatest portion of truth into the world, and died with the greatest self-devotion for that truth of which God has made him the word, I prayed for truth and courage. Never can I forget the words which I murmured in that hour, so critical to my moral life. Perhaps my prayer was heard; a bright ray of reason and conviction diffused itself through my understanding, giving me more clearly to distinguish light from darkness, error from truth. There are moments in the life of man, in which his thoughts, long fluctuating like the waves of a bottomless sea in vague uncertainty, touch at length upon a shore against which they break, and roll back upon themselves with new forms, and a current contrary to that which has hitherto impelled them. Was such a moment then mine? He who sounds all thoughts knows, and the time will perhaps come when I shall comprehend it. It was a mystery in my life which will hereafter be made plain."[1]

The ancient city of Jerusalem, with the splendid structures by which it was adorned during the brilliant period of the Jewish empire, has entirely disappeared in the course of successive conquests; and although many ancient monuments, the scenes of Scripture history, are shown to travellers, it is certain that no traces remain of Jerusalem excepting the surrounding scenery, those natural features which triumph alike over time and the rage of war. One of the most splendid edifices in the modern city is the mosque of Omar already alluded to, which is said to stand on the site of Solomon's temple. It was erected in the seventh century, by the caliph whose name it bears. It is an octagonal building, with numerous windows, surmounted by a dome in form resembling that of St Paul's in London, and about half the size. It is by far the most splendid and richest monument of architectural art in Jerusalem, or, according to Dr Clarke, in the Turkish empire, and, "considered externally," he adds, "far superior to the mosque of St Sophia in Constantinople. It has an imposing effect when seen from a distance, from the commanding situation which it occupies; and it relieves in a great degree the dull, monotonous aspect of the other streets and buildings."[2] It is crowned with a cupola, which is also octagonal, having a round window of coloured glass in each of its sides; and is surmounted by a dome, formerly of gilded copper, but now of lead.[3] "The lofty Saracenic pomp," says Dr Clarke, "so nobly displayed in the style of the building, its numerous arcades, its capacious dome, with all the stately decorations of the place; its extensive area paved and variegated with the choicest marbles, the extreme neatness observed in every avenue towards it; and, lastly, the sumptuous costume observable in the dresses of all the eastern devotees, passing to and from the sanctuary, make it altogether one of the finest sights the Mahommedans have to boast."[4] No access into the interior is allowed to Christians, under pain of death; and when Dr Clarke urged his attendant to permit his entrance, he replied that his life would be the price of his compliance. In earlier times, however, when Jerusalem was in possession of the Crusaders, the interior of the mosque was visited by Europeans, who have described its architecture and decorations. It is entered by four large gates, richly ornamented, facing the four cardinal points, with six columns of marble and porphyry. The interior is of white marble, and the pavement inlaid with marble of different colours. Thirty-two columns of gray marble, in two rows, support the arched roof and the dome; around these columns are chandeliers gilded or of bronze, on which are seven thousand lamps which burn from Thursday at sun-set to Friday at mid-day, and constantly during the feast of Ramadan. The church of the Holy Sepulchre is another of the remarkable monuments of Jerusalem. It is said to be the scene of the crucifixion, entombment, and resurrection of our Saviour, though no evidence appears to identify the spot. Buckingham, who visited it in 1816, mentions that it was burned down in the year 1806, and has since been rebuilt in a style of architecture and decoration greatly inferior to the original. The general plan of the whole building, however, says Buckingham, and the arrangement of the holy station which it contains, are so exactly preserved, that the descriptions of the earliest visitors apply as correctly to its present state as to its former. In its appearance it resembles, according to Dr Clarke, who saw the original edifice, an ordinary Roman Catholic church. It presents in form a singular mixture of eastern and western architecture; a combination which, though it offends against the critical rules of taste, produces, according to this traveller, an agreeable effect. It is 300 feet long and nearly 200 broad, and was built by Helena, the mother of Constantine. Over the door there was in the first edifice a bas-relief, representing the entrance of Christ into Jerusalem, and the multitude strewing palm branches in the way. On entering the church, Dr Clarke was shown a slab of white marble in the pavement, surrounded by a rail, which he was told was the spot where our Sa-

[1] *Pilgrimage to the Holy Land*, vol. ii. p. 27–35.
[2] *Travels through Palestine*, p. 205.
[3] Chateaubriand, *Itinéraire de Paris à Jerusalem*, vol. ii. p. 370.
[4] *Travels in Greece, Egypt, and the Holy Land*, vol. ii. p. 602.

Jerusalem. viour's body had been anointed by Joseph of Arimathea. There is not the slightest proof of the identity of any of these holy places; but the authority of these legends is still kept up as a device for exacting money from the travellers and pilgrims who visit this celebrated city. The interior of this strange fabric is divided into two parts. The first is a kind of ante-chapel, on entering which, the visitors are shown, before the mouth of the sepulchre, a block of white marble, on which it is affirmed that the angel sat after the Saviour was laid in the tomb. The sepulchre itself is composed of thick slabs of that beautiful breccia commonly called verd-antique marble; and the entrance is rugged and broken, owing to so many fragments being carried off as relics. The interior of the original edifice was adorned with Corinthian columns of fine marble; but these being destroyed by the fire, the dome is now supported by tall and slender square pillars of masonry, plastered on the outside, and placed so thickly together as to produce the worst effect. The mean architecture of the central dome, and of the whole rotunda which surrounds the sepulchre itself, can only, says Buckingham, be exceeded by the wretched taste of its painted decorations. The attention of this last traveller was attracted by the capitals of two very large pillars, evidently very ancient. They were placed on two short, thick shafts, and serve to support the roof of a grotto in which the holy cross is said to have been found by St Helena. For every incident in the history of the Saviour's death and resurrection there is in this church a suitable locality. The place is pointed out where Christ was derided by the soldiers; where the soldiers divided his garments; where he was nailed to the cross, &c.; to all which miserable inventions implicit credit is attached by the credulous multitude who seek admission to the Holy Sepulchre. This place is the scene of the most impious extravagancies and absurdities, in which the Greek and Latin Christians equally participate during their festivals at Easter; and they frequently contend with each other, even to the shedding of their blood, for the privilege of first entering in to celebrate mass. In the galleries round the church are small buildings, containing apartments for the reception of friars and pilgrims; and almost every Christian nation maintained here a society of monks. But these, owing to the severe extortions of the Turks, have many of them deserted the holy city, though the Greeks and Latins, and also some Armenians, Copts, and Abyssinians still remain. Lamps are continually kept burning in the sepulchre. The last and most important monument which is shown is the tomb itself where Christ's body is said to have lain, another of those delusions which seem to form the staple manufacture of the holy city. Vast crowds nevertheless resort to visit the sepulchre; and Buckingham observes that his stay there was very short. "The crowds," he says, "pressing at the door; the smallness of the aperture at the entrance; the confined space within, hung round with crimson damask, and ornamented with silver lamps and painting; the hurry and bustle occasioned by the worshippers searching for their shoes left at the door, as every one went in barefooted; the struggles to be the first to get near enough to kiss the marble; and sometimes the forcibly putting off the turbans of those who might have forgotten to uncover their heads; presented altogether a scene of such confusion, that, added to the risk of suffocation in so impure an atmosphere, it drove us by rapidly to make room for others." The Holy Sepulchre, after having been for some time the most honoured sanctuary of the Christians, became a heathen altar, where pagan rites were celebrated. The Turks, who now possess it, suffer the tomb of the Messiah to remain unmolested, in consideration of the money paid to them by the Christian pilgrims for the privilege of visiting it. About forty paces from the sepulchre, beneath the roof of the same church, and on the same level, are shown two rooms, one above another. Close by the entrance into the lower chamber or chapel, were formerly the tombs of Godfrey of Bouillon, and of Baldwin, kings of Jerusalem. But these, we are informed by Buckingham, have been spitefully destroyed by the rival sect of the Greeks, so that not a vestige of them remains to mark even the spot on which they stood. At the extremity of the chapel is a fissure or cleft in the natural rock, said to have taken place in consequence of the earthquake that occurred at the crucifixion. This spot is narrated as Mount Calvary, the place of our Saviour's passion; and here, upon a contracted piece of masonry, are shown the marks of the three crosses on which Christ suffered, along with the two thieves. "After this," says Dr Clarke, "the traveller may be conducted through such a farrago of absurdities, that it is wonderful the learned men who have described Jerusalem should have filled their pages with any serious detail of them."

There is no evidence, however, to prove the identity of these holy places with the events of which they are supposed to have been the scene. It cannot, as is said, be Mount Calvary, for there is no mount; and in order to explain away this glaring inconsistency, it is affirmed that Mount Calvary was levelled to make way for the foundations of a church; that the sepulchre of Christ alone remained after the levelling had taken place, in the centre of the area; and that this was encased with marble; "not a syllable of which," says Dr Clarke, "is supported by any existing evidence offered in the contemplation of what is now called the tomb." Dr Clarke, denying that the places described to be Mount Calvary and the scene of the crucifixion had any claim to be so considered, was of opinion that he had discovered the real site where these great events took place. Having quitted the city of Jerusalem by the seven gates, and descended into a dingle or trench called Tophet or Gehinnom, he discovered, as he reached the bottom of the narrow dale, upon the sides of the opposite mountains, a number of excavations in the rock, which exhibited a series of subterranean chambers hewn with marvellous art, and containing repositories for the dead carved upon the sides of the solid rock. The doors were so low that it was necessary to stoop in order to procure an entrance, and to creep, in some instances, on the hands and knees; the doors were also grooved for the reception of immense stones, once squared and fitted for the grooves, by way of closing the entrances. These cemeteries are works of such labour and magnificence, that they might justly be considered as the sepulchres of kings. One, however, appears to have been constructed for a single individual; and from this circumstance, and from their being situated without the city, Dr Clarke concludes that here was the sepulchre of Joseph of Arimathea, and the place where our Lord was crucified; which was, according to the concurring testimony of all the evangelists, "the place of a skull," or a public cemetry, in the Hebrew, *Golgotha*. There are Greek inscriptions over the doors of these sepulchres, one of which is "of the Holy Sion." Continuing his researches further eastward along this dingle, and in the place called Aceldama, other ancient sepulchres were discovered by Dr Clarke, containing inscriptions and ancient paintings, executed after the manner of those found on the walls of Herculaneum and Pompeii; excepting that the figures represented were those of the apostles, the virgin, &c. with circular lines as symbols of glory encompassing their heads. These paintings were on the sides and on the roof of each sepulchral chamber; and although much injured by the Arabs or Turks, they still preserved a wonderful freshness of colour. These tombs are not nearly so ancient as those that were first noticed, being evidently constructed by Christians, after the dispersion, as Dr Clarke conjectures, of the Jews during the reign of Hadrian. At the foot of the Mount of Olives, on the east side of the brook Kedron, are the "sepulchre of the virgin," and those of the "patriarchs." The first is a cave hewn out with surprising skill and labour, in a rock of hard limestone, and is of great antiquity. The descent into this receptacle for the dead is by a flight of fifty marble steps, each of them twenty feet wide; within is a lofty and spacious vault, the largest of the *cryptæ* near Jerusalem, containing the tombs, real or imaginary, of the Virgin, of Joseph, of Anna, and of Caiaphas, with appropriate chapels to each. History throws no light upon the origin of this monument of human labour; and Dr Clarke, after the most careful examination, confesses himself unable to assign any probable era for its construction. The "sepulchres of the patriarchs" face that part of Jerusalem where the temple of Solomon was formerly erected. No representation has ever been given of these remarkable monuments that conveys an adequate idea of their grandeur. Their massive structure, the boldness of their design, and their sombre hue, as well as that of the surrounding rocks, impart to them a certain air of grandeur and sublimity, which is lost in the representation. In order to form two of these sepulchres, namely, those which are called the sepulchres of Absalom and Zechariah, the solid substance of the mountain has been cut away, and a sufficient area having in this manner been excavated, two monuments of prodigious size appear in the midst, cut out of an entire block of stone, and adorned with columns that appear to support the edifice. These columns are in the ancient style of the Doric order. The date of them has never yet been determined, nor by what people they have been erected. They are a continuation of one vast cemetery, extending along the base of all the mountainous elevations which surround Jerusalem on its southern and eastern sides; and whilst they are monuments of prodigious labour, such as were erected in those times by despotic kings, who could command labour to any extent, they also evince great progress in the arts, and, according to Dr Clarke, must have been the work of a powerful and flourishing people. There are other sepulchres to the north-west of Jerusalem, by the Damascus gate, which are minutely described by Maundrell.[1] An entrance cut out of the natural rock leads into an open court of about forty paces square; at the end of this court is a portico nine paces long and four broad, hewn out of the natural rock. An architrave running along its front, and sculptured with fruits and flowers in a light and airy style, is still discernible, though much defaced. At the end of the portico is the passage into the sepulchres, which consist of seven chambers cut out of the natural rock, and about seven or eight yards square, and exactly regular and just. In one of these was found the lid of a white marble coffin, exquisitely sculptured. It is mentioned by Maundrell, that he found one of the doors of the chambers of ash and of stone, and about six inches thick, still hanging; and it turned upon its hinges, which were also of stone. All knowledge of the origin of these singular structures is lost in remote antiquity, and the conjectures of travellers on the subject seem to be futile and vain.

Chateaubriand endeavours to prove that this was the tomb of Herod the tetrarch. Buckingham, however, considers his reasons as being far from conclusive; and, objecting also to the theories of Pococke and Clarke, he observes, "that, considering the changes of masters which Jerusalem has suffered, and the consequent variation in the taste of its possessors, it is at this moment a matter of extreme difficulty to separate the monuments of high antiquity from those of a more modern age, or to decide what parts of their remains preserve their original form, and what parts have been subsequently altered or ornamented by later hands." Such are the different impressions made by the same objects, that the last traveller, in reference to the observations of Dr Clarke, remarks, "that though this is the largest, the most extensive, and the most interesting of the monuments he had visited, there is not one which can be called either 'enormous' or 'splendid,' without the strangest abuse of terms." "The Jews," says M. de Lamartine, "had no architecture of their own; they borrowed from Egypt, from Greece, but more particularly, I think, from India. The key of every thing is in India; the generation of ideas and arts appears to me to go back there; they created Assyria, Chaldea, Mesopotamia, Syria; the great cities of the desert, as Balbec; then Egypt, then the islands of Crete and Cyprus; then Etruria, then Rome; then night came on, and Christianity, cradled at first by the Platonic philosophy, and afterwards by the barbarous ignorance of the middle ages, gave birth to our civilization and our modern arts."[2] Such is a specimen of the theories in which not only imaginative poets, but even sober, matter-of-fact travellers, are sometimes prone to indulge.

The ancient city of Jerusalem was so entirely destroyed that nothing remained by which the original plan could be traced, and hence the controversies still maintained among the learned respecting its localities. The more durable features of nature, however, still remain. From history we learn that the ancient city stood upon four eminences, with one very deep valley and two smaller ones dividing them. The most conspicuous of these eminences was that of Sion, called the Holy Hill, and the citadel of David to the south of the city. To the north of Sion was the hill of Acra; and on the east the third eminence, Mount Moriah, upon which was built the temple. It was bounded by the sepulchral caves on the north, by Mount Sion on the south, by the brook Kedron, which runs through the valley of Jehoshaphat, on the east, beyond which was the Mount of Olives, and by the hill of Acra on the west. There seems to be considerable uncertainty about the identity of these hills, though the Mount of Olives, covered with olive trees, still vindicates its origin; and the brook Kedron, receiving from its fountains, which yet abound in excellent water, the rivulet, or the dirty little brook, as Buckingham calls it, of Siloam, flows through the valley of Jehoshaphat; and the valley of Hinnom divides Mount Sion from Mount Moriah.

Jerusalem has long been celebrated as one of the holy places of the Christians, and has not only been the resort of numerous pilgrims, but the permanent residence of monks and Christians from various countries, such as the Latins, Greeks, Armenians, and Copts, who each of them have here a monastery and a church. The Latin convent of St Salvador is a large, irregular building, like a fortress, with courts and galleries within, and some small spaces of garden-land without, forming a safe retreat in time of intestine trouble. It is entered from a hilly street, by a large iron-cased door, beneath an overhanging building, which darkens the passage, and gives an air of gloom to the whole. Beyond this is a small open paved court below, with other still darker passages leading to the first flight of stairs. These being ascended, a range of galleries, winding in various directions, leads to the private apartments and domestic offices of the convent; and courts beyond, and terraces above, afford sufficient space for walks both morning and evening, with a commanding view of all Jerusalem and the surrounding country. In this edifice, Dr Clarke mentions that he was received by a body of the most corpulent friars he had ever beheld, who resembled the figures brought in

[1] *Journey from Aleppo to Jerusalem*, p. 76, 77

[2] *Pilgrimage to the Holy Land*, vol. ii. p. 80.

this country upon the stage by way of burlesquing the monkish character.

The friars are of the Franciscan order, who are under a vow of perpetual poverty, and live by alms. They are furnished with a bed and bedding, a table, wash-hand basin and jug, a lamp, a crucifix, and a chair, at the expense of the church, to which they may add other conveniences from their own funds. This convent of Jerusalem is called, by way of distinction, "Il Convento della Terra Santa," and is at the head of all the Catholic establishments throughout the Holy Land. It is recruited with monks from Naples, Sicily, and from the south of Spain, who, according to the account of Buckingham, are extremely discontented, and complain much of their banishment to this remote spot. The superior is immediately dependent on the pope; and the funds of the institution are supplied chiefly from Rome, aided by donations from other Catholic countries. The liberality of Ferdinand, king of Spain, was particularly extolled; and even the prince regent of England, afterwards George IV., had sent a gift of L.1500. The establishment of the convent consists of eighty-eight persons, who all mess together. The fast-days of the church are regularly observed; and the daily services of prayers and of masses, which are frequent and tedious. The morning hour of service is five; coffee is made at this hour, of which they all partake; they dine at ten, and sleep till past noon. There is no restriction at any time in the allowance of bread, wine, and vegetables, all of which are excellent. The monks are clothed once in two years, with an under garment, and outer cloak of dark-brown cloth, with the white knitted cord of St Francis, with which it is understood that they are to flagellate themselves for their sins. Strangers properly recommended, and especially if it is thought they can protect the convent, by their influence, from the exactions of the Turks, which are often heavy, are hospitably entertained in a room allotted for them. The monastery possesses considerable funds and stores. Dr Clarke was regaled with coffee, lemonade, and excellent tea, which was served profusely in bowls. The apartments are all paved with stone; and there are no less than twenty-two wells of excellent water within the walls. The discipline is strict, and implicit obedience is exacted by the superior, under pain of excommunication. All the inferior convents in Palestine and Syria are subject to this metropolitan convent: they are supplied from its funds when voluntary contributions fail; and all appointments are made by the superior. The church of the convent is not remarkable for size or beauty, though it is gaudily furnished with gilded candlesticks, censers, images, &c. and has a fine altar and an organ. The Greek monastery consists of many small establishments, which are said to be well supported. The church is partly subterranean, and is small and mean, the Greeks bestowing all their wealth on the decoration of the Holy Sepulchre. The Armenian convent is distinguished above all others for neatness and comfort, and for the cheerful aspect of the place. This edifice, with its church and gardens, occupies that point of the supposed Mount Zion that is within the city. The establishment is well provided with every comfort; its funds, contributed entirely by rich individuals, are superior to those of the other convents; and all Armenian worshippers and pilgrims are maintained here during their stay in the holy city. The church, which is supposed, according to the traditions current in Jerusalem, to be built on the spot where James the brother of John was killed with the sword, has a gorgeous and imposing appearance. Though small, it is lofty; the walls are everywhere covered with pictures, executed in the worst taste, yet, from their profusion and gay colouring, producing an agreeable effect. The pillars, as well as the portals of the door and the inner walls, are all cased with porcelain tiles, painted blue, with crosses and other devices; and the mosaic pavement is the most beautiful of its kind. The whole is carefully covered with rich Turkey carpets, excepting only a small space before the altar. To the left is a small recess, the pretended spot where St James was beheaded. It is ornamented with white marble sculpture, massy silver lamps, gilding and painting, which produces a surprising richness of effect. The door is even more beautiful, being composed entirely of tortoise-shell, mother-of-pearl, gold, and silver, all so exquisitely inlaid, that the skill of the workman seems to vie with the costliness and beauty of the materials. The altars, which front the door of the entrance, are all splendid; and the massy vessels, crosses, mitres, and candlesticks, of gold and silver, flowers, gems, and precious stones, have an appearance of splendour and richness which cannot be excelled. The Jews have a synagogue in a low and obscure street near the centre of the town, which is a large suit of subterranean rooms lighted by small windows. Here Mr Buckingham and Mr Bankes saw worship performed on the Jewish sabbath.

The population of Jerusalem is estimated, though not upon any accurate data, at between 20,000 and 30,000. The Mahommedans are the most numerous; and these consist of nearly equal portions of Osmanlee Turks from Asia Minor, descendants of pure Turks by blood, but Arabians by birth; a mixture of Turkish and Arab blood by intermarriages; and pure Syrian Arabs of an unmixed race. The few Europeans in Jerusalem consist only of the monks of the Catholic convent, and the still fewer Latin pilgrims who visit them. The Greeks are the most numerous. The Armenians are the next in order; and the inferior sects of Copts, Abyssinians, Syrians, Nestorians, Maronites, Chaldeans, &c. are scarcely perceptible in the crowd. The Jews amount to 1000 males and 3000 females; a great number of widows resorting to the holy city, where they are maintained by their own community. Their great happiness is to die at Jerusalem, and to be buried in the valley of Jehoshaphat. Though the Jews come from the most distant parts, they are easily distinguished by their dress and their physiognomy, which, says Buckingham, is "strikingly natural." The city is most populous from Christmas to Easter, and at the latter festival it is crowded, and exhibits a singular variety of costumes and languages. The only manufacture which flourishes at Jerusalem is that of crucifixes, chaplets, beads, crosses, shells, and relics, of which whole cargoes are shipped off for Italy, Portugal, and Spain. From the general sterility of the surrounding country, during the parching droughts of summer, every article of food is dear, and wages are high. The force usually maintained here consists of a thousand troops, Turks, Arabs, and Albanians.

Jerusalem is said to have been founded in the year of the world 2023, and at that time to have occupied only the two hills of Moriah and Acra. Fifty years after its foundation, it was taken by the Jebusites, descendants of Jebus, the son of Canaan, who built a fortress on Mount Zion, and gave to it the name of their father. Joshua made himself master of the lower town of Jerusalem, whilst the Jebusites remained masters of the citadel, from which they were dislodged by David, 824 years after the building of the city. David enlarged the citadel, and built a palace near it; and during the prosperous reign of Solomon the city was embellished by the celebrated temple. Palestine was afterwards invaded by the kings of Egypt, of Assyria, and, finally, by the king of Babylon; and by the latter, after having been previously plundered, it was utterly destroyed, and the Jews were carried away captive to Babylon. This happened in the year of the world 3513, about 600 years before the Christian era, 466½ years after the foundation of the temple by Solomon. After the conquest of Babylon by Cyrus, permission was given to the Jews to return to their own country. The work of rebuilding the city and temple of Jerusalem was begun, after seventy years of captivity, by Zerubbabel, and finished by Nehemiah. After the conquest of Persia by Alexander, and the division of his empire among his generals, the Jews endeavoured to regain their independence, which they with difficulty maintained against powerful neighbours. Jerusalem was taken by Ptolemy, and afterwards by Antiochus Epiphanes, who sacked the city, and placed an idol of Jupiter in the temple. The country was afterwards invaded by the kings of Asia, the successors of Alexander, who attempted to subjugate the country, and to impose on the Jews the idol worship of the Greeks. The patriotism and bravery of the Maccabees enabled the Jews successfully to resist these invaders. Jerusalem was at last subdued by the Romans, after which Jesus Christ appeared, and suffered in the city. The Jews rebelling against the tyranny of the Roman pro-consuls in the reign of Nero, the city was taken by Titus after a long siege, and given up to pillage, and the inhabitants were mostly taken and carried into slavery. A remnant was left till the reign of Adrian, who, incensed by repeated disturbances, razed the city completely to the ground, and on its ruins erected the Roman town of Ælia Capitolina. Jerusalem retained this name till the end of the seventh century, when Christianity, having been embraced by Constantine, became the established religion of the empire. The name of Jerusalem was then resumed, and the Empress Helena, the mother of Constantine, overthrew the idols that had been placed on the tomb of the Saviour, and caused to be erected the church which still remains, and which has been already described. Thirty years afterwards, in the year 363, the Emperor Julian, with a view of disproving the Christian prophecies, attempted to rebuild the temple, which attempt was, however, frustrated, according to the traditions of that age, by a miraculous interposition. During the progress and establishment of Christianity in the Roman empire, Jerusalem was enlarged and embellished, and became the resort of numerous pilgrims from all countries. About the year 636 the city was taken by the Caliph Omar, after a siege of four months, and was still a pious resort of numerous pilgrims, who were encouraged by the Turks to visit the Holy Sepulchre, as they derived a considerable profit from the tax which they imposed on them. Palestine was overrun by an inroad of the Turks in the year 1076, after which the defenceless pilgrims were exposed to continual outrage and violence from this barbarous people. The intelligence of their sufferings being carried to Europe, inflamed the zeal of the Christian world, and gave rise to those remarkable expeditions, the Crusades, for the deliverance of the Holy Land. Jerusalem was re-captured by the army under Godfrey of Bouillon, who was created king of Jerusalem, which city was held upwards of sixty years by five Latin kings, when it was again conquered by the Turks under Saladin, and was finally annexed to the Ottoman empire in 1517. Long. 35. 20. E. Lat. 31. 47. 47. N. (F.)

JESI, a city of Italy, in the province of Ancona, in the papal dominions. It is the see of a bishop, and contains a cathedral, five churches, seven monasteries, and five nunneries, and has 5000 inhabitants, whose chief occupation is making woollen and silk stockings. It is situated on the river Esino, about five miles from the Adriatic Sea, in a district rich in olives, wine, and mulberries.

JESSES, ribbons which hang down from garlands or crowns in falconry; also short straps of leather fastened to the hawk's legs, and so to vervels.

JESTING, or *concise wit*, as distinguished from continued wit or humour, lies either in the thought or the language, or both. In the first case it does not depend upon any particular words or turn of the expression. But the greatest fund of jests lies in the language, that is, in tropes or verbal figures; those afforded by tropes consist in the metaphorical sense of the words, and those of verbal figures principally turn upon a double sense of the same word, or a similitude of sound in different words. The third kind of jokes, which lie both in the sense and language, arise from figures of sentences, where the figure itself consists in the sense, but the wit turns upon the choice of the words.

JESUITS, or *the Society of Jesus*, a famous religious order of the Roman Catholic church, founded by Inigo de Loyola, called also Ignatius Loyola. The plan which this fanatic formed of its constitution and laws was suggested, as he gave out, and as his followers still teach, by the immediate inspiration of heaven. But, notwithstanding this high pretension, his design met at first with violent opposition. The pope, to whom Loyola had applied for the sanction of his authority to confirm the institution, referred his petition to a committee of cardinals; and as they represented the establishment as not only unnecessary, but dangerous, Paul refused to grant his approbation. At last, however, Loyola removed all his scruples by an offer which it was impossible for any pope to resist. He proposed, that besides the three vows of poverty, chastity, and monastic obedience, which are common to all the orders of regulars, the members of his society should take a fourth vow of obedience to the pope, binding themselves to go whithersoever he should command them for the service of religion, and without requiring any thing from the holy see for their support. At a time when the papal authority had received a severe shock by the revolt of so many nations from the Romish church; at a time when every part of the popish system was attacked with so much violence and success; the acquisition of a body of men thus peculiarly devoted to the see of Rome, and whom it might set in opposition to all its enemies, was an object of the highest consequence. Paul instantly perceiving this, confirmed the institution of the Jesuits by his bull, granted the most ample privileges to the members of the society, and appointed Loyola to be the first general of the order. The event fully justified Paul's discernment, in expecting such beneficial consequences to the see of Rome from this institution. In less than half a century, the society obtained establishments in every country that adhered to the Roman Catholic church; its power and wealth increased amazingly; the number of its members became great; their character as well as accomplishments were still greater; and the Jesuits were celebrated by the friends and dreaded by the enemies of the Catholic faith, as the most able and enterprising order in the church.

The constitution and laws of the society were perfected by Lainès and Aquaviva, the two generals who succeeded Loyola; men far superior to their master in abilities and in the science of government. They framed that system of profound and artful policy which distinguishes the order. The large infusion of fanaticism mingled with its regulations should be imputed to Loyola its founder. Many circumstances concurred in giving a peculiarity of character to the order of Jesuits, and in forming the members of it not only to take a greater share in the affairs of the world than any other body of monks, but also to acquire superior influence in the conduct of them.

The primary object of almost all the monastic orders is to separate men from the world, and from any concern in its affairs. In the solitude and silence of the cloister, the monk is called to work out his own salvation by extraordinary acts of mortification and piety. He is dead to the world, and ought not to mingle in its transactions. He can be of no benefit to mankind but by his example and by his prayers. The Jesuits, on the contrary, were taught to consider themselves as formed for action. They were chosen soldiers, bound to exert themselves continually in the service of God, and of the pope his vicar upon earth. Whatever tended to instruct the ignorant, whatever could be of use to reclaim or to oppose the enemies of the holy see, was their proper object. That they might have full leisure for this active service, they were totally exempted from those functions the performance of which forms the chief business of other monks. They appeared in no processions; they practised no rigorous austerities; they did not consume one half of their time in the repetition of tedious offices. But they were required to attend to all the transactions of the world, on account of the influence which these might have upon religion; they were directed to study the dispositions of persons in high rank, and to cultivate their friendship; and, by the very constitution as well as genius of the order, a spirit of action and intrigue was infused into all its members.

As the object of the society of Jesuits differed from that of the other monastic orders, the diversity was no less in the form of its government. The other orders might be considered as voluntary associations, in which whatever affected the whole body was regulated by the common suffrage of all its members. The executive power was vested in the persons placed at the head of each house or of the whole society; but the legislative authority resided in the community. Affairs of moment, relating to particular houses, were determined in conventual chapters; but such as respected the whole order were considered in general congregations. But Loyola, full of the ideas of implicit obedience, which he had derived from his military profession, provided that the government of his order should be purely monarchical. A general, chosen for life by deputies from the several provinces, possessed power which was supreme and independent, extending to every person and to every case. He, by his sole authority, nominated provincials, rectors, and every other officer employed in the government of the society, and he could remove them at pleasure. In him was vested the sovereign administration of the revenues and funds of the order. Every member belonging to it was at his disposal; and by his uncontrollable mandate he could impose upon them any task, or employ them in whatsoever service he pleased. To his commands they were required to yield not only outward obedience, but even to resign to him the inclinations of their own wills and the sentiments of their own understandings. They were to listen to his injunctions as if these had been uttered by Christ himself. Under his direction they were to be mere passive instruments, like clay in the hands of the potter, or like dead carcasses incapable of resistance. Such a singular form of policy could not fail to impress its character upon all the members of the order, and to give a peculiar force to all its operations. There is not in the annals of mankind any example of such a perfect despotism, exercised not over monks shut up in the cells of a monastery, but over men dispersed amongst all the nations of the earth.

As the constitutions of the order vested in the general absolute dominion over all its members, they carefully provided for his being perfectly informed with respect to the character and abilities of his subjects. Every novice who offered himself as a candidate for entering into the order was obliged to manifest his conscience to the superior, or a person appointed by him; and required to confess not only his sins and defects, but to discover the inclinations, the passions, and the bent of his soul. This manifestation they were required to renew every six months. The society, not satisfied with penetrating in this manner into the innermost recesses of the heart, directed each member to observe the words and actions of the novices. They were constituted spies upon their conduct, and were bound to disclose every thing of importance concerning them to the superior. In order that this scrutiny into their character might be as complete as possible, they served a long noviciate, during which they passed through the several gradations of ranks in the society; and they must have attained the full age of thirty-three years before they could be admitted to take the final vows, by which they became professed members. By these various methods, the superiors, under whose immediate inspection the novices were placed, acquired a thorough knowledge of their dispositions and talents. In order that the general, who was the soul which animated and moved the whole society, might have under his eye every thing necessary to inform or direct him, the provincials and heads of the several houses were obliged to transmit to him regular and frequent reports concerning the members under their inspection. In these they descended into minute details respecting the character of each person, his abilities natural or acquired, his temper, his experience in affairs, and the particular department for which he was best fitted. These reports, when digested and arranged, were entered into registers kept on purpose, that the general might at one comprehensive view survey the state of the society in every corner of the earth; observe the qualifications and talents of its members; and thus choose, with perfect information, the instruments which his absolute power could employ in any service for which he thought fit to destine them.

As it was the professed intention of the order of Jesuits to labour with unwearied zeal in promoting the salvation of men, this engaged them of course in many active functions. From their first institution, they considered the education of youth as their peculiar province; they aimed at being spiritual guides and confessors; they preached frequently in order to instruct the people; and they set out as missionaries to convert unbelieving nations. The novelty of the institution, as well as the singularity of its objects, procured the order many admirers and patrons. The governors of the society had the address to avail themselves of every circumstance in its favour; and in a short time the number as well as influence of its members increased prodigiously. Before the expiration of the sixteenth century, the Jesuits had obtained the chief direction of the education of youth in every catholic country of Europe. They had become the confessors of almost all its monarchs; an office of no small importance in any reign, but, under a weak prince, superior even to that of the minister himself. They were the spiritual guides of almost every person eminent for rank or power. They possessed the highest degree of confidence and interest with the papal court, as the most zealous and able champions of its authority. The advantages which an active and enterprising body of men might derive from all these circumstances are obvious. They formed the minds of men in their youth, and they retained an ascendant over them in their advanced years. They possessed, at different periods, the direction of the most considerable courts in Europe. They mingled in all affairs; they took part in every intrigue and revolution. The general, by means of the extensive intelligence which he received, could regulate the operations of the order with the most perfect discernment; and, by means of his absolute power, could carry them on with the utmost vigour and effect.

Along with the power of the order, its wealth continued to increase. Various expedients were devised for eluding the obligation of the vow of poverty. The order acquired ample possessions in every catholic country; and, by the number as well as magnificence of its public buildings, together with the value of its property, moveable or real, it vied with the most opulent of the monastic fraternities. Besides the sources of wealth common to all the regular clergy, the Jesuits possessed one which was peculiar to themselves. Under pretext of promoting the success of their missions, and of facilitating the support of their missionaries, they obtained a special license from the court of Rome to trade with the nations which they laboured to convert. In consequence of this, they engaged in an extensive and lucrative commerce both in the East and West Indies. They opened warehouses in different parts of Europe, in which they vended their commodities. Not satisfied with trade alone, they imitated the example of other commercial societies, and aimed at obtaining settlements. They accordingly acquired possession of a large and fertile province in the southern continent of America, and reigned as sovereigns over some hundred thousand subjects.

Unhappily for mankind, the vast influence which the order of Jesuits acquired by all these different means was often exerted with the most pernicious effect. Such was the tendency of that discipline observed by the society in forming its members, and such were the fundamental maxims in its constitution, that every Jesuit was taught to regard the interest of the order as the capital object to which every consideration was to be sacrificed. This spirit of attachment to their order, the most ardent perhaps that ever influenced any body of men, is the characteristic principle of the Jesuits, and serves as a key to the genius of their policy as well as the peculiarities in their sentiments and conduct.

As it was for the honour and advantage of the society, that its members should possess an ascendancy over persons in high rank or of great power, the desire of acquiring and preserving such a direction of their conduct with greater facility led the Jesuits to propagate a system of relaxed and pliant morality, which accommodates itself to the passions of men, justifies their vices, tolerates their imperfections, and authorizes almost every action that the most audacious or crafty politician would wish to perpetrate.

As the prosperity of the order was intimately connected with the preservation of the papal authority, the Jesuits, influenced by the same principle of attachment to the interests of their society, were the most zealous patrons of those doctrines which tend to exalt ecclesiastical power upon the ruins of civil government. They attributed to the court of Rome a jurisdiction as extensive and absolute as was claimed by the most presumptuous pontiffs in the dark ages. They contended for the entire independence of ecclesiastics on the civil magistrates. They published such tenets concerning the duty of opposing princes who were enemies of the catholic faith, as countenanced the most atrocious crimes, and tended to dissolve all the ties which connect subjects with their rulers.

As the order derived both reputation and authority from the zeal with which it stood forth in defence of the Romish church against the attacks of the Reformers, its members, proud of this distinction, considered it as their peculiar function to combat the opinions and to check the progress of the Protestants. They made use of every art, and employed every weapon against them. They set themselves in opposition to every gentle or tolerating measure in their favour; and they incessantly stirred up against them all the rage of ecclesiastical and civil persecution.

Monks of other denominations have indeed ventured to teach the same pernicious doctrines, and have held opinions equally inconsistent with the order and happiness of civil society. But, from reasons which are obvious, they either delivered such opinions with greater reserve, or propagated them with less success. Whoever recollects the events which have happened in Europe during two centuries, will find that the Jesuits may justly be considered as responsible for most of the pernicious effects arising from that corrupt and dangerous casuistry, from those extravagant tenets concerning ecclesiastical power, and from that intolerant spirit, which have been the disgrace of the church of Rome throughout that period, and which have brought so many calamities upon civil society.

But, amidst many bad consequences flowing from the institution of this order, mankind, it must be acknowledged, have derived from it some considerable advantages. As the Jesuits made the education of youth one of their capital objects, and as their first attempts to establish colleges for the reception of students were violently opposed by the universities in different countries, it became necessary for them, as the most effectual method of acquiring the public favour, to surpass their rivals in science and industry. This prompted them to cultivate with extraordinary ardour the study of ancient literature. It put them upon various methods for facilitating the instruction of youth; and, by the improvements which they made in education, they contributed so much towards the progress of polite learning, that upon this account they have merited well of society. Nor has the order of Jesuits been successful only in teaching the elements of literature; it has likewise produced eminent masters in many branches in science, and can alone boast of a greater number of ingenious authors than all the other religious fraternities taken together.

But it is in the new world that the Jesuits exhibited the most wonderful display of their abilities, and contributed most effectually to the benefit of the human species. The conquerors of that unfortunate portion of the globe had nothing in view but to plunder, to enslave, and to exterminate its inhabitants. The Jesuits alone made humanity the object of their settling there. About the beginning of the seventeenth century, they obtained admission into the fertile province of Paraguay, which stretches across the southern continent of America, from the bottom of the mountains of Potosi to the confines of the Spanish and Portuguese settlements on the banks of the river La Plata. They found the inhabitants in a state very little different from that which takes place amongst men when they first begin to unite together; strangers to the arts, subsisting precariously by hunting or fishing, and hardly acquainted with the first principles of subordination and government. The Jesuits set themselves to instruct and to civilize these savages. They taught them to cultivate the ground, to rear tame animals, and to build houses. They brought them to live together in villages. They trained them to arts and manufactures. They made them taste the sweets of society, and accustomed them to the blessings of security and order. These people became the subjects of their benefactors, who governed them with a tender attention, resembling that with which a father directs his children. Respected and beloved almost to adoration, a few Jesuits presided over some hundred thousand Indians. They maintained a perfect equality amongst all the members of the community. Each of them was obliged to labour, not for himself alone, but for the public. The produce of their fields, together with the fruits of their industry of every species, were deposited in common storehouses, from which each individual received every thing necessary for the supply of his wants. By this institution, almost all the passions which disturb the peace of society, and render the members of it unhappy, were extinguished. A few magistrates, chosen for the most part by the Indians themselves, watched over the public tranquillity, and secured obedience to the laws. The sanguinary punishments frequent under other governments were unknown. An admonition from a Jesuit, a slight mark of infamy, or, upon some singular occasion, a few lashes with a whip, were sufficient to maintain good order amongst these innocent and happy people.

But even in this meritorious effort of the Jesuits for the good of mankind, the genius and spirit of their order mingled and were discernible. They plainly aimed at establishing in Paraguay an independent empire, subject to the society alone, and which, by the superior excellence of its constitution and police, could scarcely have failed to extend its dominion over all the southern continent of America. With this view, in order to prevent the Spaniards or Portuguese in the adjacent settlements, from acquiring any dangerous influence over the people within the limits of the province subject to the society, the Jesuits endeavoured to inspire the Indians with hatred and contempt of these nations. They cut off all intercourse between their subjects and the Spanish or Portuguese settlements. They prohibited any private trader of either nation from entering their territories. When they were obliged to admit any person in a public character from the neighbouring governments, they did not permit him to have any conversation with their subjects; and no Indian was allowed even to enter the house where these strangers resided, unless in the presence of a Jesuit. In order to render any communication between them as difficult as possible, they industriously avoided giving the Indians any knowledge of the Spanish or of any other European language; but encouraged the different tribes which they had civilized to acquire a certain dialect of the Indian tongue, and laboured to make that the universal language throughout their dominions. As all these precautions, without military force, would have been insufficient to render their empire secure and permanent, they instructed their subjects in the European arts of war. They formed them into bodies of cavalry and infantry, completely armed and regularly disciplined. They provided a great train of artillery, as well as magazines stored with all the implements of war. Thus they established an army so numerous and well appointed, as to be formidable in a country where a few sickly and ill-disciplined battalions composed all the military force kept on foot by the Spaniards or Portuguese.

Such were the laws, the policy, and the genius of this formidable order, of which, however, a perfect knowledge has only been of late attainable. Europe had observed, for two centuries, the ambition and power of the order. But whilst it felt many fatal effects of these, it could not fully discern the causes to which they were to be imputed. It was unacquainted with many of the singular regulations in the political constitution or government of the Jesuits, which formed the enterprising spirit of intrigue that distinguished its members, and elevated the body itself to such a height of power. It was a fundamental maxim with the Jesuits, from their first institution, not to publish the rules of their order. These they kept concealed as an impenetrable mystery. They never communicated them to strangers, nor even to the greater part of their own members. They refused to produce them when required by courts of justice; and, by a strange solecism in policy, the civil power in different countries authorized or connived at the establishment of an order of men, whose constitution and laws were concealed with a solicitude which alone was a good reason for excluding them. During the prosecutions carried on against them in Portugal and France, the Jesuits were so inconsiderate as to produce the mysterious volumes of their institute. By the aid of these authentic records, the principles of their government may be delineated, and the sources of their power investigated, with a degree of certainty and precision which, previously to that event, it was impossible to attain. The pernicious effects, however, of the spirit and constitution of this order rendered it early obnoxious to some of the principal powers in Europe, and gradually brought on its downfall. The Emperor Charles V. saw it expedient to check its progress in his dominions; it was expelled from England by a proclamation of James I. in 1604, from Venice in 1606, from Portugal in 1759, from France in 1764, from Spain and Sicily in 1767, and it was totally suppressed and abolished by Pope Clement XIV. in 1773. In 1801, Pius VII. re-established the society of Jesuits, but only for Russia; and in 1814, the same pope re-established it throughout the whole earth. The following judicious and discriminating character of the order is from the masterly pen of Sir James Mackintosh, and forms the conclusion of the eighth chapter of his Historical View of the Reign of James II.

" The party which had now the undisputed ascendant was denominated Jesuits, as a term of reproach, by the enemies of that famous society in the church of Rome, as well as among the Protestant communions. A short account of their origin and character may facilitate a faint conception of the admiration, jealousy, fear, and hatred, the profound submission or fierce resistance, which that formidable name once inspired. Their institution originated in pure zeal for religion, glowing in the breast of Loyola, a Spanish soldier; a man full of imagination and sensibility, in a country where wars, rather civil than foreign, waged against unbelievers for ages, had rendered a passion for spreading the catholic faith a national point of honour, and blended it with the pursuit of glory as well as with the memory of past renown. The legislative forethought of his successors gave form and order to the product of enthusiasm, and bestowed laws and institutions on their society which were admirably fitted to its various ends. Having arisen in the age of the reformation, they naturally became the champions of the church against her new enemies. Being established in the period of the revival of letters, instead of following the example of the unlettered monks, who decried knowledge as the mother of heresy, they joined in the general movement of mankind; they cultivated polite literature with splendid success; they were the earliest, and, perhaps, the most extensive reformers of European education, which, in their schools, made a larger stride than it has at any succeeding moment; and, by the just reputation of their learning, as well as by the weapons with which it armed them, they were enabled to carry on a vigorous contest against the most learned impugners of the authority of the church. Peculiarly subjected to the see of Rome by their constitution, they became ardently devoted to its highest pretensions, in order to maintain a monarchical power, of which they felt the necessity for concert, discipline, and energy in their theological warfare.

" While the nations of the Spanish peninsula hastened with barbaric chivalry to spread religion by the sword in the newly explored regions of the East and the West, the Jesuits alone, the great missionaries of that age, either repaired or atoned for the evils caused by the misguided zeal of their countrymen. In India they suffered martyrdom with heroic constancy. They penetrated through the barrier which Chinese policy opposed to the entrance of strangers; they cultivated the most difficult of languages with such success as to compose hundreds of volumes in it; and, by the public utility of their scientific acquirements, they obtained toleration, patronage, and personal honours, from that jealous government: and the natives of America, who generally felt the superiority of the European race only in a more rapid or a more gradual destruction, and to whom even the excellent Quakers dealt out little more than penurious justice, were, under the paternal rule of the Jesuits, reclaimed from savage manners, and instructed in the arts and duties of civil life. At the opposite point of society they were fitted, by their release from conventual life, and their allowed intercourse with the world, for the perilous office of secretly guiding the conscience of princes. They maintain the highest station as a religious body in the literature of catholic countries. No other association ever sent forth so many disciples who reached such eminence in departments so various and unlike. While some of their number ruled the royal penitents at Versailles or the Escurial, others were teaching the use of the spade and the shuttle to the naked savages of Paraguay; a third body daily endangered their lives in an attempt to convert the Hindus to Christianity; a fourth carried on the controversy against the reformers; a portion were at liberty to cultivate polite literature, and the greater part continued to be employed either in carrying on the education of catholic Europe, of which they were the first improvers, or in the government of their society, in ascertaining the ability and disposition of the junior members, so that well-qualified men might be selected for the extraordinary variety of offices in their immense commonwealth. The most famous constitutionalists, the most skilful casuists, the ablest schoolmasters, the most celebrated professors, the best teachers of the humblest mechanical arts, the missionaries who could most bravely encounter martyrdom, or who with most patient skill could infuse the rudiments of religion into the minds of ignorant tribes or prejudiced nations, were the growth of their fertile schools. The prosperous administration of such a society for two centuries is probably the strongest proof afforded from authentic history that an artificially formed system of government and education is capable, under some circumstances, of accomplishing greater things than the general experience of it would warrant us in expecting from it. Even here, however, the materials were supplied and the first impulse given by enthusiasm; and in this memorable instance the defects of such a system are discoverable. The whole ability of the members being constantly, exclusively, and intensely directed to the various purposes of the order, the mind of the Jesuits had not the leisure or liberty necessary for works of genius, or even for discoveries in science, to say nothing of original speculations in philosophy, which are interdicted by implicit faith. That great society, which covered the world for two hundred years, has no names which can be opposed to those of Pascal and Racine, produced by the single community of Port Royal, which was in a state of persecution during the greater part of its short existence. But this remarkable peculiarity amounts perhaps to little more than that they were more eminent in active than in contemplative life. A far more serious objection is the manifest tendency of such a system, while it produces the precise excellences aimed at by its mode of cultivation, to raise up all the neighbouring evils with a certainty and abundance, a size and malignity, unknown to the freer growth of nature. The mind is narrowed by the constant concentration of the understanding; those who are habitually intent on one object, learn at last to pursue it at the expense of others equally or more important. The Jesuits, the reformers of education, sought to engross it, as well as to stop it at their own point. Placed in the front of the battle against the Protestants, they caught a more than ordinary portion of that theological hatred against their opponents which so naturally springs up where the greatness of the community, the fame of the controversialist, and the salvation of mankind, seem to be at stake. Affecting more independence in their missions than other religious orders, they were the formidable enemies of episcopal jurisdiction; and thus armed against themselves the secular clergy, especially in Great Britain, where they were the chief missionaries. Intrusted with the irresponsible guidance of kings, they were too often betrayed into a compliant morality; excused probably to themselves by the great public benefits which they might thus obtain by the numerous temptations which seemed to palliate royal vices, and by the real difficulties of determining, in many instances, whether there was more danger of deterring such persons from virtue by unreasonable austerity, or of alluring them into vice by unbecoming relaxation. This difficulty is indeed so great, that casuistry has, in general, vibrated between these extremes, rather than rested near the centre. To exalt the papal power, they revived the scholastic doctrine of the popular origin of government, that rulers might be subject to the people, while the people themselves, on all questions so difficult as those which relate to the limits of obedience, were to listen with reverential submission to the judgment of the sovereign pontiff, the common pastor of sovereigns and subjects, the unerring oracle of humble Christians in all cases of perplexed conscience. The ancient practice of excommunication, which, in its original principle, was no more than the expulsion from a community of an individual who did not observe its rules, being stretched so far as to interdict intercourse with offenders, and, by consequence, to suspend duty towards them, became, in the middle age, the means of absolving nations from obedience to excommunicated sovereigns. Under these specious colours both popes and councils had been guilty of alarming encroachments on the civil authority. The church had indeed never solemnly adopted the principle of these usurpations into her rule of faith or of life, though many famous doctors gave them a dangerous continuance. She had not condemned, or even disavowed, those equally celebrated divines who resisted them; and though the court of Rome undoubtedly patronized opinions so favourable to its power, the catholic church, which had never pronounced a collective judgment on them, was still at liberty to disclaim them, without abandoning her haughty claim of exemption from fundamental error. On the Jesuits, as the most staunch of the polemics who struggled to exalt the church above the state, and who ascribed to the supreme pontiff an absolute power over the church, the odium of these doctrines principally fell. Among reformed nations, and especially in Great Britain, the greatest of them, the whole order was regarded as incendiaries, perpetually plotting the overthrow of protestant governments, and as immoral sophists, who employed their subtle casuistry to silence the remains of conscience in tyrants of their own persuasion. Nor was the detestation of Protestants rewarded by general popularity in catholic countries. All other regulars envied their greatness; the universities dreaded their acquiring a monopoly of education. Monarchs, the most zealously catholic, though they often favoured individual Jesuits, often also looked with fear and hatred on a society who would reduce them to the condition of vassals of the priesthood; and in France, the magistrates, who preserved their integrity and dignity in the midst of general servility, maintained a more constant conflict with these formidable adversaries of the independence of the state and the church. The kings of Spain and Portugal envied their well-earned authority, in the missions of Paraguay and California, over districts which they had conquered from the wilderness. The impenetrable mystery in which a part of their constitution was enveloped, though it strengthened their association, and secured the obedience of its members, was an irresistible temptation to abuse power, and justified the apprehensions of temporal sovereigns, while it opened an unbounded scope for heinous accusations. Even in the eighteenth century, when many of their peculiarities had become faint, and they were perhaps little more than the most accomplished, opulent, and powerful of religious orders, they were charged with spreading secret confraternities over France. Their greatness became early so invidious as to be an obstacle to the advancement of their members; and it was generally believed that if Bellarmine had belonged to any other than the most powerful order in Christendom, he would have been raised to the chair of Peter. The court of Rome itself, for whom they had sacrificed all, dreaded auxiliaries who were so potent that they might easily become masters. These champions of the papal monarchy were regarded with jealousy by popes whose policy they aspired to dictate or control. Temporary circumstances at this time created a more than ordinary alienation between the Jesuits and the Roman court. They, in their original character of a force raised for the defence of the church against the Lutherans, always devoted themselves to the temporal sovereign who was at the head of the catholic party; they were attached to Philip II. at the time when Sextus V. dreaded his success; and they now placed their hopes on Louis XIV., in spite of his patronage, for a time, of the independent maxims of the Gallican church. On the other hand, Odeschalchi, who governed the church under the name of Innocent XI., feared the growing power of France, resented the independence of the Gallican church, and was, to the last degree, exasperated by the insults offered to him in his capital by the command of Louis. He was born in the Spanish province of Lombardy, and, as an Italian sovereign, he could not be indifferent to the bombardment of Genoa, and to the humiliation of that respectable republic, by requiring a public submission from the doge at Versailles. As soon, then, as James became the pensioner and creature of Louis, the resentments of Odeschalchi prevailed over his zeal for the extension of the church.

"The Jesuits had treated himself, and those of his predecessors who hesitated between them and their opponents, with offensive liberty. While they bore sway at Versailles and St James's, they were on that account less obnoxious to the Roman court. Men of wit remarked at Paris, that things would never go well till the pope became a Catholic, and King James a Huguenot. Such were the intricate and dark combinations of opinions, passions, and interests, which placed the nuncio in opposition to the most potent order of the church, and completed the alienation of the British nation from James, by bringing on the party which now ruled his councils the odious and terrible name of Jesuits."

J E S U S.

JESUS, the Divine Author of the Christian religion, was born at Bethlehem, a city of the tribe of Judah, about six miles south-east from Jerusalem. His mother was a Jewish virgin named Mary, the betrothed wife of Joseph, both in the humblest rank of life, though both of the royal race of David. The date of his birth is not mentioned in the sacred record; and there has been a difference of opinion among the learned who have engaged in the inquiry, respecting the precise period when it took place. It is now, however, generally agreed upon, that it must be fixed a few years earlier than is indicated by the epoch of our era, which, according to the common computation, corresponds with A. U. 754. We know that Jesus was born before the death of Herod the Great;[1] and it appears from Josephus,[2] that Herod died before the Jewish passover A. U. 750. From calculations founded on other parts of the gospel history, and particularly on a comparison between Luke, iii. 1 and 23, many have supposed that the nativity was in A. U. 747; and in this opinion some have been confirmed by the conjecture of Kepler, that the conjunction between Jupiter and Saturn, which took place in that year, was the star seen by the wise men; though it may be justly questioned how far the principles of scriptural interpretation admit of the supposition that the phenomenon referred to corresponds with the particulars mentioned by St Matthew.[3] In regard to the day or month in which the Saviour was born, a subject to which the devotion of a large proportion of the Christian world has attached much importance, we have no means of accurate knowledge. The description given[4] of shepherds watching their flocks by night, is inconsistent with the idea that it could have been in December or January, or during the heat of the summer months; as we know that in these periods the herds were no longer left in the fields.[5] At other times of the year the flocks might be turned out to pasture day and night in the south of Palestine; but there is no circumstance referred to by any of the evangelists to determine whether it was in spring or in autumn that Jesus was born.[6]

The chronological error in the vulgar era, and in the season for celebrating the festival of Christmas, does not in any way affect the truth of the gospel history; and cannot indeed appear strange, when it is considered that several centuries elapsed before the method of computing time by the birth of Christ was introduced, and that the festival of the nativity was not observed in the primitive church. During the first three centuries, the Christians adopted the ordinary modes of reckoning time, which prevailed among the heathen around them. Different methods were afterwards employed; and it was not till the sixth century that a Roman abbot named Dionysius the Less was induced, by motives of religion, to have recourse to the expedient of determining dates by the number of years from the period when the Son of God was born of a woman. The commemoration of the day of the nativity was not generally observed throughout the Christian world till the fourth century. At that time the western church fixed upon the 25th of December, and their example was generally followed.[7] Different causes have been assigned for the choice of this day. Sir Isaac Newton, in his work on Daniel, supposes that it was agreeably to the principle by which the chief feasts were fixed at the cardinal points, without regard to historical accuracy; as the annunciation at the vernal equinox, and St John the Baptist's day at the summer solstice. Hospinian and others have been of opinion that the festivities connected with the celebration of Christmas were intended to make up for the Saturnalia, conformably to the practice which had been acted upon from an earlier period, of smoothing the way for the conversion of the heathen, by

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[1] Matt. ii. 1, 16.

[2] *Antiq.* 17, 18, 1; *Comp.* 14, 14, 5, and 17, 9, 3.

[3] Matt. ii. 2, 7, 9. A list of the opinions which have been entertained respecting the year of our Saviour's birth is to be found in the *Bibliographia Antiquaria* by Fabricius, and in Münter's *Stern der Weisen. Untersuchungen über das Geburtsjahr Christi.* See also Hales' *Chronology*, vol. i.

[4] Luke, ii. 8.

[5] "Pluvia prima descendit, die 17, M. Marchevan (Novem.), tunc armenta redibant domum nec pastores in tuguriis amplius habitabant in agris," &c. (*Gemar. Nedar.* 63.) Again, we read in Jerome, that in summer, "juxta ritum Palestinæ et multarum orientis provinciarum quæ ob pratorum et fœni penuriam paleas præparant usui animantium." (*Comm. Is.* lib. viii.)

[6] Various attempts have been made to connect the birth of Jesus with the feast of the Passover and the feast of Tabernacles; but the conclusions have been generally drawn from vague and fanciful analogies, and do not rest on historical grounds. See Hales' *Chronology*, vol. i.; and Greswell's *Dissertations on the Harmony of the Gospels*, diss. x.

[7] Clemens Alexandrinus mentions (Strom. i.), that some celebrated the natvity on the 20th of May, others on the 20th of April. The 6th of January was celebrated by the Basilidian Gnostics as the day of the nativity and of the baptism. This custom afterwards became general for a time throughout the East. And when the birth-day was fixed by the western church on the 25th of December, the 6th of January continued to be observed as the Epiphany.

presenting their idolatrous ceremonies under a new form. And there is not wanting reason to suppose, that from the winter solstice being observed as the birth-day of the sun, when that luminary, returning from the south, seemed to be restored to the world, the transition was suggested to the celebration of the birth of him who was the life and light of the world.[1]

The circumstances connected with the birth of Jesus corresponded in a remarkable degree with the predictions of the Jewish prophets respecting the Messias. He belonged to the tribe of Judah, and was of the house of David. Events, over which his earthly kindred had no control, fixed his birth at Bethlehem, from which place the promised Deliverer was to spring. The seventy prophetic weeks of Daniel were approaching to their termination. And so determinate were these and other predictions, that a general opinion prevailed, even in heathen countries, that the tide of time was bringing our race to a mighty epoch, and that a prince was to arise in the East who was to obtain the empire of the world.[2] The wisdom of Divine Providence was also shown in the appointed scene and season of the birth of Jesus. From the geographical situation of Palestine, forming a part of Asia, touching upon Africa, and connected by the Mediterranean with the whole of Europe, the Jews enjoyed the best opportunities of diffusing the knowledge of their principles. And the intercourse between remote nations, occasioned by the conquests of Alexander and the progress of the Roman arms, afforded increased facilities for propagating new opinions, while it forced upon men's notice the different forms of national worship, and led to an examination of the great principles of religious belief.

Soon after the birth of Jesus, his parents fled with him to Egypt, to save him from the fury of Herod, whose suspicions were awakened by the idea of a rival to his throne.[3] An uncertain tradition fixes the spot of the residence of the holy family at Matarea, near the ancient Heliopolis; and one of the apocryphal gospels contains various idle accounts of miracles which marked the presence of a superior being. From such traditions the Jews took occasion to circulate many ridiculous tales of magical arts learned by Jesus while in Egypt, which were frequently referred to by some of the early philosophic opponents of the Christian faith. The malignant insinuations of Celsus, however, and the absurd legends which long found currency among the Jews, are wholly inconsistent with the authentic narrative of the return from Egypt upon the death of Herod, when Jesus might still be said to be in infancy.

Upon their arrival in Palestine, Joseph was led to take up his residence in Nazareth, in Galilee. Here the opening character of Jesus engaged the love and excited the admiration of all who knew him.[4] And, even before his childhood was ended, in his twelfth year, when his parents carried him up to one of the annual Jewish feasts, we find him attracting the notice of the learned Rabbis, entering into discussion with them, and filling them with astonishment at his extraordinary knowledge and sagacity. It would appear that, according to the custom of his countrymen, he followed the trade of his foster-father. In Mark, vi. 3, he is spoken of familiarly as "the carpenter."[5] And Justin Martyr tells us, that while he sojourned on earth, he was employed in the ordinary occupations of a carpenter.[6]

In this lowly situation, and in the midst of these servile employments, a character was silently maturing, such as the world had never before witnessed; and those lofty designs were conceived, the accomplishment of which was to give a new impress to the condition of society, and to alter the destiny of our race. Frequent attempts have been made to explain by the operation of natural causes, how, in circumstances so unfavourable, a character like that of our Saviour's could have arisen; and various theories have been framed respecting the manner in which the plan to which he devoted himself was suggested to his mind. The insufficiency of these attempts we shall afterwards consider. In the mean time, however, it may be remarked, that, though no explanation can be given, from circumstances merely external, of the growth of such a mind as that of Jesus, which must be sought only in the seed of the immortal plant itself, it is by no means inconsistent with the highest ideas that can be entertained of the divinity of his nature, to suppose a progression in the development of his humanity. External influences must to a certain extent modify the character of every man. We are told, accordingly, that "he *grew* in *wisdom*" as well as "stature." And the commanding situation and romantic beauty of the city of his dwelling, the instructions of his mother, intercourse with the heathen, which, from the proximity of Nazareth to Galilee of the Gentiles, must have been frequent, may have proved among the subordinate aids for awakening that sense of the loveliness and majesty of external nature to which we find so many references in his discourses, and that susceptibility of every tender emotion which his whole history manifested, and that enlarged philanthropy which looked beyond the distinctions of Jew and Gentile, of sect and class, of rank and station, and considered the whole human race as members of one great family, as children of the same heavenly parent. Such influences, however, are matter of conjecture rather than of positive knowledge; for no reference is made to them by any of the Evangelists. The piety of his mother and of Joseph renders it certain that he would from infancy be made acquainted with the Old Testament Scriptures; and these not only contain the germ of all that is pure and elevating in religious sentiment, but also are, more than any other study, calculated to awaken the curiosity and stimulate the powers of the opening mind. His conversation and discourses everywhere show that he must have made a constant study of the sacred records. It appears that he never attended any rabbinical school, nor did he receive a learned education.[7]

From the time when he appeared disputing with the Jewish doctors in the temple, we have no direct information respecting him till his thirtieth year, when we find him among those who presented themselves to John upon the banks of the Jordan to be baptized. The intervening period was no doubt employed in maturing the plan for the arduous undertaking to which he was prompted by the stirrings of the Divinity within him. The consciousness of his high vocation, however, to a career that was to attract the notice of the world, did not interfere with the pious observance of his filial duties, or the laborious discharge of the common offices of his early situation.[8] The baptism of John served as a consecration to his new office. The heavens were opened, the Holy Spirit

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[1] Schroekh's *Kirchengeschicte*, i. 403.

[2] Tac. *Hist.* v. 13; Suet. *in Vesp.* cap. iv.; Virg. *Poll.*

[3] Matt. ii. 13.

[4] Luke, ii. 52.

[5] Ὀυκ ὁυτος ἐστι ὁ τέκτων ὁ ὑίος Μαρίας. This passage seems to have been tampered with as early as the time of Origen, probably from a wish to do away the prejudice that existed in many minds against the idea of a Saviour in such a state of humiliation. There is another reading, ὁ του τεκτονος ὑιος και Μαρίας; but the weight of evidence is decidedly in favour of the former.

[6] Τεκτονικὰ ἔργα ἠργαζετο, ἐν ἀνθρωποις ὢν, αροτρα και ζυγα. Tryph. 88. See also Theod. 3, 23; and Soz. 6, 2.

[7] Matt. xiii. 54; John, vii. 15.

[8] Luke, ii. 51; and Just. Mart. *ut sup.*

descended upon him, and a voice was heard from heaven declaring him to be the Son of God, and claiming for him the attention of mankind. Immediately after his initiation, he was impelled to retire into the solitudes of a wilderness, with a view, probably, of meditating on the work before him; and, by fasting and prayer, after the example of former prophets, to prepare himself for his great undertaking. A higher purpose was also accomplished during this retirement, an opportunity being afforded him for proving the purity and sinlessness of his nature, and establishing his fitness for the office upon which he had entered, by baffling the temptations of Satan.

After this mysterious conflict, Jesus returned to Bethabara, a place near to that part of the river Jordan over which the Israelites had passed under Joshua. It was here that disciples first began to gather around him; and few passages in history are more interesting than that[1] which tells of the individuals who first attached themselves to his cause; of their curiosity, their doubts, their conferences with him, the influence he gained over their minds, and their eagerness to communicate to others the wondrous tidings, that they had found the promised Messias in the person of Jesus of Nazareth. The first two individuals who joined themselves to him were disciples of John the Baptist, who pointed out Jesus when walking at a little distance, as the "Lamb of God who taketh away the sins of the world." Upon this they introduced themselves to his notice, and on his invitation accompanied him to the house where he lodged. What took place at this memorable interview, or how a solitary and almost unknown stranger attached to his cause the first two disciples, we are not informed; whether by some token of supernatural knowledge or power, or by the natural influence of a superior mind; the conviction was produced; and with it was imparted the spirit, which was at the foundation of the indefinite extension of the new cause, viz. the desire of imparting their own impressions of the new doctrines to others. One of the two individuals was Andrew, brother of Simon, who afterwards became so eminent in the primitive history of Christianity. "Andrew first findeth his own brother, and saith, we have found the Messias; and *he brought him to Jesus*." These three were the converts of the first day; and in a short time, without any advantages of birth or station, or human learning, without the aid of powerful relations or influential patrons, he had a considerable number of attached followers, who listened to his teaching, and accompanied him from place to place. At the feast of the Passover, along with the rest of his countrymen, Jesus went up to Jerusalem, where he increased the number of his disciples by his doctrines and miracles. He seems to have continued in the land of Judea about six or seven months; when the success of his preaching, exciting the attention and envy of the Scribes and Pharisees, led him to withdraw into Galilee, where the power of the Jewish Sanhedrim was less to be dreaded. In passing through Samaria, where the political circumstances of the inhabitants freed them from some of the prejudices of the Jews[2] respecting the character of the Messias, he first openly and publicly proclaimed the great truth, that all distinctions of Jews and Gentiles and Samaritans were to be at an end; and that, without reference to time or place, or outward ceremony, the Deity was to be worshipped in purity of spirit, and in faith on the promised Messias.[3] He then visited the whole of Galilee, everywhere accompanying the instruction he gave, in synagogues, or in private houses, or in the open fields, with miraculous proofs of his divine character and commission. In Nazareth he was first subjected to personal violence, his townsmen taking offence at his lowly origin. To avoid their malice, he passed on to Capernaum, which henceforth became the place of his general residence, and from which, as from a centre, he visited the whole surrounding country. The first year of his ministry seems to have been attended with almost universal success. He met with no outward obstruction in his work, except in Nazareth; his approach was everywhere welcomed, and increasing multitudes followed him in his progress.

During the second year of his ministry, his followers became so numerous that he chose twelve persons who might assist him in his work, and be prepared to propagate his religion when he should leave the world. These he named Apostles, an appellation which was appropriated at that time among the Jews to certain public officers who were the ministers of the high priests, and who were occasionally despatched on missions of importance to foreign parts.[4] The number twelve had probably a reference to the twelve tribes, as the seventy whom he afterwards chose might be from the number of the Jewish Sanhedrim. The increasing success of Jesus raised up against him a host of enemies, and from this time he was continually subjected to the cavils of the Sadducees, and still more of the Scribes and Pharisees, whose objections were of such a nature as might be expected from unprincipled and hypocritical men, who witnessed with jealousy any proceeding likely to diminish their influence among the people, and who were inflamed with resentment at the exposure which was made of their true character.

It has already been observed that Galilee was the chief scene of our Saviour's ministerial labours. He did not, however, confine himself wholly to that province, but occasionally visited other parts. We find him at one time on the coasts of Tyre and Sidon; at another beyond Jordan; and at the passover he uniformly went up to Jerusalem. As the Evangelists do not relate events in chronological order, we are without any precise information as to the exact degree of success that from this period attended his labours; it seems probable that his followers continued to increase, and that a deep and general impression was made upon the public mind. His proceedings at last excited the attention of all classes in Judea. Herod Antipas was haunted with the idea that he must be John the Baptist restored to life, and was desirous to have a personal interview with him; and there is not wanting reason to suppose that he received the homage of princes more remote. The eyes of the chief men of Judea were now upon him. The subject of his miracles was discussed in the Sanhedrim, and frequent attempts were made to seize and bring him before the council, though without any settled purpose, perhaps, how they were to proceed against him. At last, after the restoration of Lazarus to life, which led to the conversion of a multitude of the Jews, a meeting of the Pharisaic party was held, when it was finally determined that he should be put to death. The result is well known. In the dead of the night he was surprised in the midst of his secret devotions, hurried before the Sanhedrim, and, after the mockery of a trial, in which even his judge acknowledged his entire innocence, he was adjudged to suffer death. He was then carried to the usual place of execution, on a small hill named Calvary, on the west of Jerusalem, a little without the walls,

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[1] John, i. 29, *ad fin.* [2] See Horsley's *Sermons*, vol. ii. p. 243. See also Neander's *Geschichte der Pflanzung*, u. s. w. i. 72.

[3] Our information as to the first year of our Saviour's ministry is derived almost exclusively from John. The other Evangelists confine themselves to his preaching in Galilee, with the exception of what took place at Jerusalem immediately preceding the crucifixion.

[4] Mosheim *De Rebus Christianis*, &c. i. 6.

and there he was crucified. This dreadful scene was accompanied with signs and wonders which proclaimed the dignity of the sufferer. A supernatural darkness overspread the land of Judea, "and behold the veil of the temple was rent in twain, and the earth did quake, and the rocks rent, and the graves were opened." After his death his body was taken down from the cross, and laid in a tomb hewn out of a rock, after the manner of the Jewish sepulchres. Every precaution was used to prevent the removal of the body by the disciples. A great stone was rolled upon the door of the tomb, and a watch of Roman soldiers, consisting of sixty men, was appointed to guard it. This was on our Friday. The following day was the Jewish Sabbath; the stone remained in its place fixed and secure, and the soldiers continued their watch undisturbed. But on the morning of the third day, amidst a display of supernatural agency that mocked the precautions of the Jewish rulers, Jesus arose from the dead. After this he continued some time on earth, affording the most indubitable evidence of his identity, and of the reality of his resurrection from the dead, and instructing his disciples in the nature of the doctrine they were to teach mankind. At last, at the end of forty days, he led forth his disciples to Bethany, and there, while giving them his blessing, "he was parted from them, and carried up into heaven."[1]

The year of our Saviour's death cannot be exactly ascertained. Two extreme points, however, can be mentioned, within which that event must have taken place. The one is the fifteenth year of the reign of Tiberius,[2] in which John the Baptist began his ministry, and the other, the year in which that emperor died, when Pilate had left the province of Judea. As Jesus entered upon his ministry soon after the public appearance of John,[3] it would bring us to a near approximation to the date sought for, could we say how many passovers were celebrated by our Saviour. Even this, however, cannot be determined with certainty. The most probable opinion seems that of those who fix the number at three, and this would bring us to A. U. 783. Irenæus states that Jesus was forty or fifty years of age when he was put to death;[4] but it is generally agreed upon that his opinion was founded, not on authentic records, but to suit a fanciful theory.[5] Most of the Christian fathers assign only a single year to the ministry of Christ, and fix his death in A. U. 782. Their conclusions are drawn from an erroneous view of Isaiah, lxi. 1, and Luke, iv. 19.[6]

We have little authentic information respecting the character or history of Jesus additional to what is contained in the New Testament. The name Chrestus is mentioned by Suetonius; but it has been disputed whether he referred to Jesus.[7] Tacitus alludes to the fact of his death, and speaks of him as the founder of the sect of the Christians.[8] The chief notices of him by the fathers have been embodied in the preceding narrative. There is a passage in Josephus,[9] where his life and character are referred to in the following terms: "At that time lived Jesus, a wise man [if he may be called a man], for he performed many wonderful works. He was a teacher of such men as received the truth with pleasure. He drew over to him many Jews and Gentiles. [This was the Christ.] And when Pilate, at the instigation of the chief men among us, had condemned him to the cross, they who before had conceived an affection for him did not cease to adhere to him [for on the third day he appeared to them alive again, the divine prophets having foretold these and many wonderful things concerning him]. And the sect of the Christians, so called from him, subsists to this time." This remarkable passage is referred to by Eusebius,[10] and its genuineness was never called in question from his time till the sixteenth century, when Gifanius and Osiander refused to receive it. Since that period it has afforded matter for much controversy among the learned. In favour of the genuineness of the passage, it has been argued, that we have the undisputed fact that it is found in all the copies of the works of Josephus from the time of Eusebius. It also exists in a Hebrew translation in the Vatican; and there is an Arabic version preserved by the Maronites of Mount Libanus. In addition to this external evidence, it is urged that the number of Christians in the time of Josephus was too great to admit of the supposition that he should pass them over altogether unnoticed, an improbability which is increased by the fact that he makes mention of John the Baptist,[11] and of the death of "James, the brother of Jesus, called the Christ."[12] On the other hand, it is certain that Josephus was not himself a Christian; and yet the passage, as it stands in his writings, involves the profession of belief in the divine mission of Jesus. It is farther to be remarked, that this testimony in favour of Christ is not quoted by any of the apologists of Christianity who preceded Eusebius; and in particular, Origen,[13] while he refers to the allusion made by Josephus to the death of James, and to his account of John the Baptist, passes over in silence the passage in question, though it would have afforded a more decisive answer had it been contained in the copies of the Jewish historian then in circulation. The arguments on both sides appear plausible, and the difficulties upon either supposition cannot perhaps be removed but by the conjecture, that Josephus did introduce into his work a notice of Jesus, though without admitting him to be the Messias, and that some over-zealous Christian about the time of Eusebius had inserted some additional clauses. This opinion is now generally gone into by the continental critics. Those parts which are usually looked upon as interpolations are marked within brackets in the preceding extract.

It was scarcely possible that the appearance of so remarkable a character as that of our Saviour should not have induced many individuals, from various motives, to commit an account of him to writing. Accordingly, it appears,[14] that from the earliest period many histories of his life were in circulation. The words of St Luke seem to imply that these narratives were defective or erroneous; but there is nothing to prevent us from supposing that some of them might be the productions of men of good intentions, though deficient in the talents or information requisite for so important an undertaking. It was otherwise, however, in succeeding times. After the four gospels had been written by the Evangelists, and had been generally received as of divine authority in the Christian church, heretics and others, who departed from the true faith, had recourse to the expedient of forging gospels, epistles, &c. under the name of some of the apostles, or that of our Lord himself, to which they might refer in support of their tenets. These works were frequently formed out of the genuine gospels, with such additions and omissions as the purposes of the

1 Luke, xxiv. 51.
2 Luke, iii. 1.
3 John, i. 19, 29, 35; ii. 1.
4 Iren. ii. 22, 5; John, viii. 57.
5 Pisanski de errore Irenæi in determinanda ætate Christi, 1778.
6 Tertul.; Lact. *Instit.*; Aug.; Clem. Alex. i.
7 In his *Life of Claudius*, c. xxv. Judæos impulsore Chresto assidue tumultuantes Roma expulit.
8 Auctor nominis ejus Christus, qui Tiberio imperante per procuratorem Pontium Pilatum supplicio affectus erat. (Ann. l. xv. c. 44.)
9 *Antiq.* xviii. 3, 3.
10 *Hist. Eccles.* i. ii.; *Demonstr. Evangel.* iii. 5.
11 *Antiq.* xviii. 5.
12 *Antiq.* xx. 9, 1.
13 *C. Cels.*
14 Luke, i. 1.

Jesus. writers required. There were not wanting members of the true church who followed the same practice, with the mistaken idea that the piety of the faithful might thus be promoted, or that an answer might be afforded to some of the objections of Jews and Heathens. In the second century, Irenæus[1] tells us that the Gnostics had an innumerable multitude of spurious and apocryphal books; and in the following age they were greatly increased. The greater part of these writings perished in the course of ages. Of such of them as remained, a collection was published by Fabricius, about the beginning of last century, in his *Codex Apocryphus Novi Testamenti.* A full account of them is given, with translations, in Jones' well-known work on the Canon. Several of them were republished in London some years ago, in a work entitled *The Apocryphal New Testament.*

That these works are not to be received as genuine, may be proved by their vast inferiority to the canonical gospels, and still more decidedly by the fact, that they were not recognised by the Fathers. In *The Gospel of our Saviour's Infancy*, there are some passages which are referred to by Eusebius, Athanasius, and Chrysostom, as containing some trifling particulars of true history connected with the life of Christ, but it is not ranked by them among the inspired writings. It is worthy of remark, that it was from this production, and from *The Gospel of the Birth of Mary*, and the *Protevangelion of St James*, that Mahommed derived all his knowledge of our Saviour's life. Indeed he does not seem to have been at all acquainted with the canonical gospels; and the legends of the East in general concerning our Lord are all from apocryphal sources.[2]

There is an account in Eusebius,[3] of a message having been sent by Agbarus, king of Edessa, who had heard of the miracles of Jesus, and who requested him to come and cure him of a malady with which he was afflicted. It is added, that our Saviour wrote to him a letter, in which he promised to send one of his disciples to heal him. A translation of this correspondence from the Syriac original, contained in the archives of the church of Edessa, is given by Eusebius. Additions were afterwards made to the story,—as that Thaddeus, one of the seventy, was deputed by Thomas, after the resurrection, to fulfil the promise of the Saviour; and Evagrius[4] mentions, that our Lord not only wrote a letter, but that he sent a handkerchief also, with his picture drawn upon it. There can be no doubt that the letters mentioned by Eusebius actually existed among the records of Edessa, and that they were seen by that historian. But, in addition to the external evidence from the letters themselves, the fact that they are taken notice of by no preceding Christian writer affords demonstration that they are forgeries, which owe their existence probably to the national vanity of some of the early Christians of Edessa. We are not informed that our Saviour ever committed anything to writing, and we may be assured that if he had, it would not have passed unnoticed by his first followers.

There is another statement contained in Eusebius, deserving of more attention. He mentions that Pontius Pilate, after the crucifixion of our Lord, wrote such an account of his character and miracles to the Emperor Tiberius, as induced that prince to propose to the senate that a place should be assigned to Jesus among the deities worshipped by the Romans, but that the senate opposed the wishes of the emperor. It was certainly the custom of the governors of provinces to write memoirs of the remarkable occurrences of the places where they presided; and there is nothing improbable in the idea that Pilate, who was convinced of the innocence of Christ, should send an account of him to Tiberius. It is certain also that Justin Martyr,[5] in his Apology for the Christians, presented to the Emperor Antoninus Pius, refers to the acts of Pilate, as containing an account of the circumstances connected with the crucifixion; and Tertullian,[6] towards the end of the century, appeals to the same records. Still, however, we conceive that the evidence for the existence of these acts is defective; and the proposal alluded to by Tiberius to the Roman senate, though mentioned by Tertullian, and repeated by writers who succeeded him, is irreconcilable with the character of Tiberius, and the state of the Roman empire at that period. At a later period, a spurious work, entitled *The Acts of Pilate*,[7] was circulated by the Jews, containing many slanders against Jesus; and it appears that acts of a contrary nature were fabricated by certain Christians, to do away the impression.[8]

From the time that the Jews returned from the Babylonian captivity, a belief in magic formed a borrowed part of the national character; and at an early period the natural expedient was resorted to by the enemies of Jesus, of disparaging his character, by representing him as a magician. It was believed among them that there was a mystic word which enabled those who had learned it to direct at will the current of events; and a foolish story was circulated as early as the second century,[9] respecting the means by which Jesus discovered and remembered this potent sign. Upon this fable a life of Jesus was ultimately constructed, entitled *Toldoth Jeschu.* The substance of this abominable fabrication is, that Jesus was born in adultery, the particulars of which are detailed with revolting minuteness; that he contrived to steal the sacred word, by pronouncing which he performed miracles at will, healed the sick, opened the eyes of the blind, raised the dead; by means of such works he gained over many converts, and would have been still more successful had not another Jew disabused the minds of his countrymen by learning the same word, and disclosing to the people how the same miracles could be performed. The work terminates with an account of the death of Jesus, and of his body being stolen away by his disciples. It was published, with a Latin translation and learned notes, by Wagenseil, in his *Tela Ignea Satanæ, h. e. Arcani et horribiles Judæorum adversus Christum Deum et Christianum religionem libri* ΑΝΕΚΔΟΤΟΙ, 1681. It can scarcely be believed that the more learned among the Jews gave credit to its mendacious absurdities; though they long encouraged its circulation, to inspire their brethren with a deeper contempt for Christianity and its followers.

The determination of the questions relative to the person and character and history of Jesus involves all the essential particulars connected with the *evidences* and *doctrines* of the Christian faith. But in an article like the present, we cannot enter fully upon the consideration of any of these important subjects. We shall merely offer a few remarks upon such particulars as depend upon elements of a historical nature, leaving the discussion of matters of doctrine for other departments of this work.

The existence of such a person as Jesus Christ has scarcely ever been seriously denied; and the general tenor of the narrative of the Evangelists, with the omission of the miraculous parts, has been received as substantially correct by many who refuse to acknowledge the truth of our religion. The evidences for the genuineness and authenticity of the four Gospels will be stated under the proper

[1] C. i. c. 17. [2] Jones, vol. i. [3] *Hist. Eccles.* i. 13. [4] Evag. iv. 26. [5] *Apol.* i. [6] Tertul. *Apolog.* c. v. 21.
[7] This was during the persecution of Maximin. Euseb. *Hist. Eccles.* ix. 5.
[8] *Epiphan. Haer.* l. i. [9] Orig. *Contr. Cels.*

heads, from which it will appear that no history whatever is supported by stronger external proof; and that were it not from internal grounds as to the nature of the facts recorded, and the consequences which flow from them, the truth of the narrative would never have been called in question. Even the miracles were admitted by the earliest opponents of Christianity, Celsus, Philostratus, and Hierocles. These individuals did not deny the reality of the works performed by Jesus; they only, upon internal evidence, objected to the idea that a person in circumstances so lowly should be supposed to be divine, or explained away the supernatural appearances by the supposition of the exercise of magical arts,[1] or maintained that the few miracles which were performed did not warrant the idea of a divine character.[2]

Different ground has been taken up by infidels in modern times, who, while they have been constrained to admit the truth of the general statements of the Evangelists, have rejected altogether the supernatural machinery. In setting aside the miraculous part of the gospel history, the chief difficulty has been found in giving a consistent view of the character of Jesus. If the miracles performed by Christ were not real, the conclusion seems irresistible that he must have been either a deliberate impostor, or a self-deceived enthusiast. By some writers, accordingly, Jesus has been held up to ridicule and contempt, as exhibiting many weaknesses, and even vices—as a pretended miracle-worker and false prophet. Several of the deistical writers of our own country took up this position, and were followed by Voltaire and other French authors. The anti-Christian views of Voltaire were adopted by Frederick the Great,[3] whose example and encouragement gave rise to the spirit which has unfortunately led so many of the theologians of Germany to exclude from Christianity every trace of supernatural agency.

The notices of the English deists of the last century, respecting the miracles and character of Jesus, in many instances at least, were little more than incidental, and formed merely a part of their general argument against the truth of our religion. In Germany the work has been more systematically pursued. With the characteristic industry of that learned people, the writings of the Evangelists have been considered in every possible form. Different theories have been framed as to the secret views of Jesus, as to the real causes of his success, and as to the true character of the alleged miracles which were performed. Voltaire, after our English authors, had endeavoured to account for the exalted morality taught by Jesus, by supposing that it was borrowed from the self-denying tenets of the sect of the Essenes.[4] The idea was followed out by various German authors; while the lofty theology of the Alexandrian Platonists, and the liberal spirit of Sadduceism, were referred to by others as sufficient to originate in an enthusiastic mind the system taught by Jesus. Some, like Edelmann, while they have not disputed that a virtuous Jew named Jesus actually existed, have refused to acknowledge the genuineness and authenticity of the Gospels. Reimarus, in a posthumous tract[5] on the object of Jesus and his disciples, while he acknowledges the excellence of the morals, and even of the doctrines, of the Gospel, accuses Jesus of not observing the rules which he prescribed, and of making use of his system as a means for promoting his political views; and while he does justice to many of the high qualities of Jesus, he represents him, upon the whole, as actuated by ambition, and as aiming at the establishment of his own power under the character of the triumphant conqueror to whom the Jews looked forward in their promised Messias. His arguments are chiefly founded upon the acknowledged ideas of the Jewish people respecting the Messias, upon the caution exhibited by Jesus in arrogating that character, and upon his entering Jerusalem in royal state, when he conceived that his cause was sufficiently advanced to insure his success; while the grief he exhibited in the garden of Gethsemane, and his exclamation on the cross, "My God, my God, why hast thou forsaken me?" are considered as tokens of his disappointed hopes. This view has been taken by other writers, with various minor modifications, and with different degrees of learning and presumption. Others have represented Jesus as the dupe of his own imagination,—as one who, by the dreams of a fond mother, and the workings of an unrestrained fancy, was led to believe himself to be the Messias; and who, partly by his superior knowledge of the occult qualities of matter, and partly by the sympathetic influence of a highly-wrought enthusiasm, favoured occasionally by accidental circumstances, performed many works that seemed to exceed the limits of natural causes, which were afterwards exaggerated into real miracles. Another class of the neologian school describe Christ as a pure and exalted character, who was animated with the desire of raising the condition of his degraded countrymen, and of promoting the general interests of humanity; and who, in the lowly situation in which he was placed, found no other means of accomplishing this end but by personating the character of the Jewish Messias. As the Jews expected miracles to be performed by their long-looked-for Saviour, Jesus accommodated himself to their views in this respect. According to this class of writers, he is supposed sometimes to have availed himself of fortunate contingencies, representing the restoration from a faint as a resurrection from the dead, as in the case of the daughter of Jairus, and of Lazarus, and sometimes to have succeeded, perhaps beyond his own expectations, by the aids of animal magnetism.[6] His appearance to his disciples after his burial has

[1] Celsus.

[2] Hierocles.

[3] Frederick, while he treated with contempt the doctrines of the Gospel, acknowledged the excellence of its morality, which he considered (it is unnecessary to remark how erroneously) as essentially the same with that of the Stoics.

[4] *Dict. Phil.* art. *Essenes.* The untenableness of the theory had long before been well exposed by Prideaux, *Connections*, vol. ii. p. 284.

[5] This tract was published in 1788, by the celebrated Lessing, among his "Wolfenbüttel Fragments by an anonymous person." It is entitled *Fragment von dem Zwecke Jesu und seiner junger.* It is now universally ascribed to Reimarus, well known as an able critic, and the author of a work on natural religion. He was born at Hamburg in 1694, and died in 1765. He published nothing respecting his views as to the subject of revealed religion during his life, but he left various manuscripts of an anti-christian character, some of which falling into the hands of Lessing, who at that time had the superintendence of the ducal library at Wolfenbüttel, were published by him in the *Beiträge zur Geschichte und Literatur, aus den Schätzen der Hezoglichen Bibliothek zu Wolfenbüttel.* They excited great attention; and, more perhaps than any other work, led to the neologian spirit that has since so much prevailed in Germany. Various answers were called forth. Of these, by far the ablest was that by Reinhard, a celebrated German preacher, in a work entitled *Versuch über den Plan den der Stifter der Christ. religion zum besten der Menschen entwarf.* The main object of the author is to show that the mere plan for effecting the happiness of the species; a plan which he purposed to carry into effect, not by violence or force of arms (in opposition to the theory of Reimarus), nor by the influence of a secret society (in opposition to the wild imagination of Bahrdt), but by means of moral suasion alone,—a plan which no great man of antiquity had ever conceived, and which entered into no other religious system; proves Jesus to have been a messenger sent by God. This work by Reinhard is one of the most valuable contributions to the evidences of the truth of Christianity. It has been translated into French; and a translation of it into English has been published in America, though it seems little known in this country.

[6] A list of the writers who hold these opinions is given in Winer's *Biblishes Realwörterbuch*, s. 671.

been also explained away, as if it had been the result of natural causes; it being argued that the suspension from the cross for a few hours was insufficient to occasion death, though in a worn-out frame it might occasion a temporary swoon, from which he might be restored by the myrrh and aloes and odoriferous substances which his disciples brought to embalm him.[1]

In regard to the theory which is founded on the idea that Jesus was actuated by selfish or worldly or ambitious motives, it may safely be affirmed that it is altogether inconsistent with the facts connected with every part of his history. The whole tenor of his proceedings showed that his views were above this world. He used none of the arts necessary for gaining a party among his countrymen. He did not flatter one sect at the expense of another. He neither courted the favour of his countrymen, by inflaming their prejudices against the Romans, on the one hand; nor did he, on the other hand, artfully conciliate the favour of the Romans to be employed as a means towards attaining the sovereignty of Judea. He openly denounced the vices of the reigning sects; and though his benevolence led him to such a course of conduct as could not but excite the admiration of many among the lower orders, he made no attempt to render his popularity subservient to his personal interests; he shunned the demonstrations of popular favour, and unsparingly exposed the unworthy motives that led many to pay court to him. Not a single instance can be mentioned in which he had recourse to any means for establishing a temporal authority. His whole conduct showed that he was animated with more exalted aims. From the commencement of his ministry he asserted his divine commission, and spoke with undoubting confidence of the success of his cause. But the success of which he spoke was not in schemes of worldly greatness, but in the diffusion of truth and righteousness. He availed himself of every suitable opportunity for correcting the erroneous impressions that were entertained respecting the character of the Messias. And so far was he from entertaining views of personal aggrandisement in the character he assumed, that from the very first he intimated that the good he was to render to mankind was to be procured by laying down his life for them. And the tenor of the evangelical history proves, that in proportion to the increasing clearness with which he communicated to his chosen followers the information as to his divine character, was the expressness of his declaration that his death was at hand.

There is only a single instance that can be adduced in which there was any appearance on the part of Jesus, of the assumption of temporal authority, viz. in the case of his last entrance into Jerusalem. This has been represented by Reimarus as an unsuccessful attempt made by him, counting upon the support of the populace, to take possession of the temple and of the city. But such a view is inconsistent, not only with the proceedings of Jesus upon former occasions, but also with his conduct in Jerusalem at that very period. There was no concert between the people and Jesus or his apostles. The city of Jerusalem was filled with strangers from all parts, who had come up to attend the passover; the report of the resurrection of Lazarus had been widely circulated; when Jesus approached, curiosity assembled multitudes to behold him, and, in the enthusiasm of the moment, they rendered homage to him as a king. But Jesus did not avail himself of the feeling that was excited. He addressed to the multitude nothing calculated to rouse their passions. The jealousy of the Roman governor, sufficiently awake to the danger of an insurrection,[2] took no alarm at the approach of the procession to the temple, and Pilate made no allusion to it when Jesus was brought before his tribunal. The same day that Jesus entered into the temple he voluntarily left it for Bethany, though it is obvious, that if he had entertained the views ascribed to him, he would have availed himself of the advantages it presented to him, as the citadel that commanded the whole of Jerusalem.[3] After this he openly returned to the temple on the following days; he made no appeal to the passions of the people, but continued to address to the chief priests such denunciations as could not fail to rouse those vengeful feelings of which he had foretold that he was to be the unresisting victim.

The attempt to prove that Jesus was merely an ambitious adventurer is now generally abandoned. But many, while they admit the excellence of the personal character of Christ, endeavour to account for the supernatural parts of the gospel history on what is called the principle of accommodation, supposing that Jesus suited his proceedings to the expectations of the Jews respecting the miraculous power of their Messias. But to act upon such a principle is surely inconsistent with the simplicity and integrity of a spotless character. It is admitted by the defenders of the hypothesis referred to, that we have in Jesus Christ a character which stands single and alone in the history of mankind, free from any defect, and combining every species of excellence. We have this same Jesus, without advantage of education or outward condition, introducing a system of religion and morals such as the world had never witnessed; the only system of positive religion that does not bear on its face evidence of its falseness; a system to which the most enlightened men in every age since its first propagation have yielded their homage; and a system of morals so pure in its nature, and so comprehensive in its requirements, that while the most extraordinary progress has been made in every other subject, it might easily be proved that all that ethical inquirers have attempted is an analysis of the principles of our nature, on which the rules of the New Testament are founded, or an application of these rules to the circumstances of mankind in new conditions of society. If such a system had been originated by an individual who made no claim to supernatural assistance, we would have been presented with a moral phenomenon altogether inexplicable. But this is not the state in which we find the question. Jesus declares that he received from God all that he reveals to man. Had he offered no proof of this assertion, his moral qualities, even supposing him to have been in error, might have remained unimpeached, and he might have moved our compassionate respect, as the self-deceived enthusiast of virtue or religion. But our Saviour not only demands credence on his own authority; he makes an appeal[4] to the miracles which he wrought, in proof of his divine mission. Now, the miracles which our Saviour refers to are of such a nature, that either they must have been performed or he must have lent himself to a deceit. There is no other alternative. He could not but know whether they were actually wrought, or whether they

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[1] See, in particular, the *Leben Jesu* by Dr Paulus of Heidelberg, who conceives that his opinion is strengthened by an attempt to prove (which he has endeavoured to do in a separate tract upon the subject) that only the hands of Jesus were nailed to the cross, his feet being merely bound to it by a strong cord. But even supposing this to have been the case, which we consider as by no means established, the evidence of actual dissolution is decisive. We have in the first place the testimony of the Evangelists, then the proceedings of the soldiers in general (John, xix. 33), and then the wound inflicted by one of them with a spear, which, from the account given of it, must have entered the heart itself (v. 34.)

[2] In proof of this, see Joseph. *Antiq.* xviii. 3, 2.

[3] Michaelis.

[4] John xiv. 11.

Jesus.

were only seeming and illusory. And if the miracles were not truly performed, then we have the individual whose moral character stands in all other respects higher than that of any other of the children of men, and who was made the instrument of conferring the greatest boon that ever was made to mankind,—we have that individual guilty of an artful and criminal imposture.

In regard to the theory that the apostles filled up the picture of the character of Jesus from what they read in the Old Testament Scriptures respecting the Messias, it may be remarked, that the conception of such a character in such circumstances is a phenomenon as inexplicable upon ordinary principles as the actual existence of the prototype. And that four different writers, or that even two different writers, without having a common subject, should have given so many points of resemblance of such an extraordinary nature, and in so many varied circumstances, is altogether incredible.

Among those who admit the divine commission of Jesus, different opinions have been entertained as to the rank he holds in the scale of being. The general doctrine of the Christian church, as expressed in ancient creeds and in the confessions of reformed churches, is, that Christ exhibited in his person a union of the divine and human nature; that the second person in the Trinity was united to the man Jesus, who was God and man in one person. To avoid the difficulties which have been supposed to be involved in this mysterious doctrine, it has been maintained by some that the Son is not equal with the Father, and did not exist from eternity, but that the first created being, the highest angelic nature, was made flesh and dwelt on earth. The essence of this theory is, that the Son of God was a *creature*, but that he existed in a separate state previously to his manifestation in the form of man. It is variously modified according to the higher or lower character that is given to the Son of God; and is distinguished by the name of *Arianism*, from the individual who in the early part of the fourth century first brought the question into general discussion. According to a third class, Jesus Christ was a mere man, distinguished from other men only by being employed by God in making a revelation of his will to mankind, and superior in no respect to the prophets who appeared among the Jewish people, except in superior virtue, and in a more enlarged measure of divine countenance and assistance. This view, in its essential features, was embraced by the Ebionites, and also by Artemon and others during the second and third centuries; by Socinus in the sixteenth century, from whose name those who adopt this opinion are frequently named *Socinians*, though they assume to themselves the name of *Unitarians;* a title which is sometimes conceded by Trinitarians for the sake of distinction, though they equally hold the doctrine of the unity of the Deity. In America the name Unitarian is applied to all those who reject the doctrine of the Trinity. The differences of opinion respecting the person of Christ are connected with different views as to the object and nature of his commission. Trinitarians consider him as not only teaching a purer system of morality than the world had before known, but also as making an atonement for human guilt by his death; while Socinians and many Arians deny the doctrine of the atonement, and look upon Jesus merely as a teacher of religion and virtue.

The character of Christ, as exhibited in the Gospels, presents to us the only example, anywhere to be found, of the perfection of humanity; and the contemplation of it has ever been considered by his followers as one of the most edifying and delightful exercises of piety.[1] A constant regard to the will of God, and a delight in doing it, form the distinguishing features of his character. With this was connected the absence of all sordid, or selfish, or ambitious aims, and an enlarged and enlightened philanthropy. There is perhaps nothing more remarkable in the life of Jesus than the apparently inconsistent qualities which are blended together in one harmonious whole. We see in him the most unbending constancy united with great tenderness of feeling—hatred of sin, and compassion for the offender—a heart superior to all the allurements of pleasure, with a condescending indulgence for the innocent relaxations of life—a mind of universal philanthropy, alive to all the domestic charities—views that extended to the whole human race, and a generous compliance with national and individual peculiarities. It is difficult to conceive that the portraiture presented to us in the sacred history can be contemplated without benefit; but the chief benefit will be lost if it is forgotten that he whose life was the model of every virtue laid down that life for the sins of the world.

Those who hold the highest ideas of the divinity of Christ, admit to the fullest extent that he was also man; and the curiosity is not unnatural as to the personal appearance assumed by the Son of God. Upon this subject no direct information is given in the New Testament. From incidental notices, it has been conjectured that he was of a robust frame, and that there was nothing particularly marked in his appearance;[2] but it may be doubted how far the passages referred to bear out these conclusions. There is better evidence that the mixture of divine benignity and commanding authority which he everywhere displayed in his character, were conspicuous also in his voice and aspect.[3]

The most judicious of the fathers agree that nothing was known of the personal appearance of Christ, though inquiry upon the subject was not prohibited. During the first ages of Christianity, the church, under persecution, required a model of patient endurance; and the general opinion of the fathers[4] during that time seems to have been, that the personal appearance of Christ corresponded literally with the description in Isaiah, liii. 2, 3. There was at the same time a prohibition, founded on the second commandment, against attempting to frame any pictorial likeness of the Son of God. We read, however, of pictures of Christ in the hands of one of the Gnostic sects.[5] Alexander Severus had his bust in the chamber set apart for his devotional exercises;[6] and Eusebius relates, that many among the heathens had pictures of Christ and of his apostles, which he himself had seen.[7] At a somewhat later period, when paintings began to be admitted into churches, the attempt to present a likeness of Christ was no longer considered as unlawful; and full scope being given to the imagination of the artist, attempts were made to embody the purity, and elevation, and loveliness of the Saviour's character, in lineaments of extraordinary beauty. Certain theologians justified the attempt by explaining the description in Psalm xlv. as literally applicable to Jesus. There is a minute description of the personal appearance of Christ by the Greek ecclesiastical historian Nicephorus, who flourished about the year 1330; and another in a letter purporting to be addressed by Publius Lentulus, governor of Judea, to the Roman senate. Both of these,

[1] A catalogue of some of the most important treatises upon this subject in English is given by Bishop Newcombe, in the preface to his work on our Lord's conduct and character.

[2] John, xx. 15, and xxi. 4.

[3] John, xviii. 6; Matt. vii. 29; John, vii. 46, &c.

[4] Tertull. *De Carne Christi*, 9; *adv. Jud.* 14; Clem. Alex. *Paed.* iii. 1; Orig. *Contr. Cels.* li.

[5] Iren. i. 25.

[6] Lamprid. c. 29.

[7] L. vii. c. 18.

however, are altogether without value. As the *prosopographia* in the pretended letter of Publius is from time to time brought before the public in various forms, without any hint as to its real origin, it may be proper to state, that there is most decisive evidence of its being a mere fabrication. No trace of it is to be found before the fourteenth century. No such person as Publius Lentulus was ever governor of Judea. From the style, it is probable that it was written by some monk in the middle ages.[1]

In regard to pictures which tradition has represented as having been made while our Saviour was on earth, in addition to that already mentioned as having been sent to the king of Edessa, there was another supposed to have been imprinted upon a handkerchief belonging to Veronica. The legend is, that when Christ was led to crucifixion, Veronica, who followed him, put a handkerchief to his face, on which Christ impressed his likeness. This holy relic is still exhibited at Rome on certain festivals.[2] Eusebius speaks of a statue of Christ erected by the woman who was cured of the issue of blood, and mentions that he saw it himself at Cæsarea Philippi.[3] Julian the Apostate is said[4] to have taken it down, and erected his own statue in its place. From the representations on some ancient coins, it has been conjectured that the pillar referred to was originally erected in honour of Hadrian.[5] In the Romish church it is believed that there existed a picture of Christ by St Luke, and that there was an image of him cut out by Nicodemus in cedar wood; but these traditions are without support from antiquity, and inconsistent with many passages in the writings of the fathers. A general resemblance is to be observed in all the pictures of the Saviour; but though this has probably arisen from admiration of one traditional model, there is no evidence whatever of its genuineness. After all our inquiries, while we are warranted in supposing that the benignant majesty which distinguished his character beamed forth in his countenance, yet, in regard to any thing more definite, we must rest in the conclusion of St Austin, "qua fuerit ille facie penitus ignoramus."[6]

(D. D. D. D.)

JESUS, *the Son of* SIRACH, a native of Jerusalem, composed, about 200 B. C. the Book of Ecclesiasticus, called by the Greeks Παναρετος, "replenished with virtue." They also quote it under the title of *the Wisdom of Jesus the son of Sirah.* His grandson, who was also of the same name, and a native of Jerusalem, translated it from the Hebrew into Greek about 121 B. C. We have the Greek version, but the Hebrew text is lost.

JESROTCH, a town belonging to the Sikhs, in the province of Lahore, fifty-three miles east from Lahore. Long. 74. 19. E. Lat. 32. 28. N.

JESSELMERE, a large district of Hindustan, in the province of Ajmeer, situated about the twenty-eighth degree of north latitude, and extending to the sandy desert, which constitutes the western boundary of that province. It is a barren country, being for the most part an uninterrupted tract of sand, without rivers, and the wells being of very great depth under ground. Its complete sterility is, however, in some degree owing to the government, as the whole tract is within the limits of the periodical rains, and, if duly cultivated, would be productive. But it is an almost constant scene of hostility, from the number of petty chiefs among whom it is divided. The original inhabitants, in whose possession it still remains, are of the Hindu Brahminical religion, but few in number. The capital is of the same name, and is governed by an independent chief. Long. 72. 16. E. Lat. 27. 44. N.

JESSORE, a district of the province of Bengal, to the north-east of Calcutta, bounded on the north by the Ganges, and on the west by Dacca, Jelalpoor, and Buckergunge; on the south by the sea, and on the east by Kishenagur. In the Ayeen Akberry it is called Khalafabad. The northern part of this district is very fertile; but the southern division is in the Sunderbunds, and composed of salt marshy islands covered with trees. Some parts lie so low that embankments are found necessary to protect them against inundation. The land is fertile, and would produce rice in any quantity. At present, though so near Calcutta, these low-lying tracts are neglected and waste; and being covered with jungle, they are only resorted to by salt-makers and river-pirates, the latter of whom sally out on vessels as they pass any of the innumerable branches of the Ganges by which this marshy country is intersected. The principal towns are Jessore or Moorley, Culna, and Mahmudpoor. In reply to certain queries circulated in 1801 by the Marquis Wellesley, the inhabitants were stated at 1,200,000, in the proportion of nine Mahommedans to seven Hindus. Jessore was formerly the name of the capital; it is now called Moorley.

JET, a black, inflammable substance of the bituminous kind, harder than asphaltum, and susceptible of a good polish. It becomes electrical by rubbing, attracting light bodies like yellow amber. It swims on water, so that its specific gravity must be less than 1000; notwithstanding which it has been frequently confounded with the *lapis obsidianus*, the specific gravity of which, according to Kirwan, is no less than 1744. It also resembles cannel coal in its hardness, receiving a polish, and not soiling the fingers, &c. so that it has also been confounded with this substance. The distinction, however, is easily made between the two; for cannel coal wants the electrical properties of jet, and is likewise so heavy as to sink in water, its specific gravity being no less than 1273, whereas that of jet, as has already been said, is less than 1000.

JET *d'Eau*, a French term, used to signify a fountain which casts up water to a considerable height in the air.

JETTEE', the border made round the stilts under a pier, in certain old bridges, being the same with starling; consisting of a strong framing of timber filled with stones, chalk, or other materials, to preserve the foundations of the piers from injury.

*JETTY-HEAD, a name usually given in the royal dockyards to that part of a wharf which projects beyond the rest; but more particularly the front of a wharf, the side of which forms one of the cheeks of a dry or wet dock.

JEVER, a circle of the grand duchy of Oldenburg, in Germany, extending over 165 square miles, and containing, in twenty-four parishes, 4140 houses and 20,105 inhabitants. It is a level country, on the sea shore, and preserved from inundation by powerful dykes and sluices.

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[1] There are several manuscripts of this epistle, none of them, however, older than the fourteenth century. One of these was brought forward about twenty years ago as newly discovered in the library of the Vatican, and treated as a matter of much importance. The subject was taken up in a work entitled "In ἀυθεντια Epistolæ Publii Lentuli ad Senatum Romanum de Jesu Christ. scriptæ denuo inquirit J. P. Gables," 1819, in which the whole question is fully discussed. An exposure of the fabrication is also to be found in the *American Biblical Repository*, vol. ii. p. 367.

[2] Boland. ad d. 4 Feb.

[3] *Hist. Eccles.* vii. 18.

[4] Soz. v. 21; Philostorg. vii. 3.

[5] Giesler's *Kirchengeschichte*, i. p. 79.

[6] *De Trin.* 4, 5.

The capital, of the same name, is a fortified city, containing two churches, 650 houses, and 3460 inhabitants. There is a gymnasium, and the boards for the civil and ecclesiastical affairs of the circle are held here. It has some foreign trade, consisting chiefly in the exportation of corn. Long. 7. 47. 36. E. Lat. 53. 34. 30. N.

JEWEL, any precious stone, or ornament set with precious stones.

Jewels formed part of the ornaments with which the Jews, Greeks, and Romans, especially their ladies of distinction, adorned themselves. So great was the extravagance of the Roman ladies in this respect, that Pliny the Elder says he saw Lollia Paulina with an equipage of this kind, amounting, according to Dr Arbuthnot's calculation, to L.322,916. 13s. 4d. of our money. It is worthy of observation, that precious stones amongst the Romans, and all the ancients, were much scarcer, dearer, and consequently in higher estimation, than amongst us, since a commerce was opened with the Indies. The ancients did not know how to cut and polish them to much perfection; but coloured stones were not scarce, and they cut them very well either hollow or in relief. When luxury had gained ground amongst them, the Romans hung pendants and pearls in their ears; and for this purpose the ears of both sexes were frequently bored. See Ears.

Jewel, *John*, a learned English divine, was born in the year 1522, and educated at Oxford. In 1540, having been created bachelor of arts, he became a noted tutor, and was soon afterwards chosen rhetorical lecturer in his college. In February 1544, he took his degree as master of arts. Having early imbibed protestant principles, he inculcated the same on his pupils; but this was carried on privately till the accession of Edward VI. in 1546, when he made a public declaration of his faith, and entered into a close friendship with Peter Martyr, then professor of divinity at Oxford. In 1550, he took the degree of bachelor of divinity, and frequently preached with great applause before the university. At the same time he preached and catechised every alternate Sunday, at Sunningwell in Berkshire, of which place he was rector. Upon the accession of Queen Mary in 1553, he was one of the first who felt the effects of the storm then raised against the Reformation; for, before any law was made, or order given by the queen, he was expelled from Corpus Christi College by the fellows, of their own private authority; but he continued in Oxford till he was called upon, under the severest penalties, to subscribe to some of the Catholic doctrines, a call which he submitted to. However, this did not secure his safety, for he was obliged to fly; and, after encountering many difficulties, he arrived, in the second year of Mary's reign, at Frankfort, where he made a public recantation of his subscription to the Catholic doctrines. He then went to Strasburg, and afterwards to Zurich, where he attended Peter Martyr, in whose house he resided. He returned to England in 1558, after Queen Mary's death; and, in 1559, was consecrated Bishop of Salisbury. This promotion was conferred upon him as a reward for his great merit and learning; and another attestation was given him by the university of Oxford, which, in 1565, conferred upon him in his absence the degree of doctor in divinity. In this character he attended the queen to Oxford the following year, and presided at the theological disputations held before her majesty on that occasion. He had before distinguished himself by a sermon preached at St Paul's cross, in which he gave a public challenge to all the Roman Catholics in the world to produce but one clear and evident testimony, out of any father or famous writer who flourished within six centuries after Christ, for any one of the articles which the Romanists maintain against the church of England; and, two years afterwards, he published his famous Apology for this church. In the mean time, he paid particular attention to his diocese, where, in his visitations, he began, and at length perfected, such a reformation, not only in his cathedral and parochial churches, but in all the churches within his jurisdiction, as procured him and the whole order of bishops due reverence and esteem. He was a careful and strict observer, not only of all the flocks, but also of the pastors, in his diocese; and he watched so narrowly the proceedings of his chancellor and archdeacons, and of his stewards and receivers, that they had no opportunities of committing oppression, injustice, or extortion, nor of being a burden to the people, or a scandal to himself. Amidst these employments, however, he neglected the care of his health, to which, indeed, his general course of life was unfavourable. He rose at four o'clock in the morning; and, after prayers with his family at five, and in the cathedral about six, he applied so intensely to his studies all the morning, that he could not without difficulty be drawn from them. After dinner his doors and ears were open to all suitors; and it was observed of him, as of Titus, that he never sent any away sorrowful. About nine at night he called all his servants to an account of how they had spent the day, and he went to prayers with them. From the chapel he withdrew again to his study till near midnight, and thence retired to bed, when the gentleman of his bed-chamber read to him till he fell asleep. This watchful and laborious life, without any recreation at all, except what his necessary refreshment at meals and a very few hours of rest afforded him, soon wasted his life. He died at Monkton-Farley, in 1571, in the fiftieth year of his age. He was the author of, 1. A View of a Seditious Bull sent into England by Pope Pius V. in 1569; 2. A Treatise on the Holy Scriptures; 3. An Exposition of St Paul's two Epistles to the Thessalonians; 4. A Treatise on the Sacrament; 5. An Apology for the National Church; 6. Several sermons, controversial treatises, and other works. Bishop Jewel was one of the great champions of the reformed religion, and was to the church of England what Bellarmine was to that of Rome. His Apology was translated by Anne, the second of the four learned daughters of Sir Anthony Coke, and mother of Sir Francis Bacon. It was published, as it came from her pen, in 1564, with the approbation of the queen and the prelates. The same Apology was printed in Greek at Constantinople, under the direction of St Cyril the patriarch. His defence of his Apology, against Harding and other Catholic divines, was held in such esteem, that Queen Elizabeth, King James I. King Charles I. and four successive archbishops, ordered it to be kept chained in all parish churches for public use.

Jewel Blocks, in nautical language, a name given to two small blocks suspended at the extremities of the main and fore top-sail yards, by means of an eye-bolt driven from without into the middle of the yard-arm, parallel to its axis. The use of these blocks is to retain the upper part of the top-mast studding-sails beyond the skirts of the top-sails, so that each of those sails may have its full force of action, which would be diminished by the encroachment of the other over its surface. The halyards, by which these studding-sails are hoisted, are accordingly passed through the jewel-blocks, whence, communicating with a block on the top-mast head, they lead downwards to the top or decks, where they may be conveniently hoisted.

JEWS.

The character and fate of this singular people, in their relation to the Christian faith, belong to other departments of this work. In the present article we shall confine ourselves to a brief outline of the leading events in their annals, as a part of general history. They derive their origin from Abraham, a native of Chaldea, who flourished about 2000 years before the Christian era. At that period the whole world was sunk in idolatry, and Abraham was chosen by the Almighty, that by him and his posterity the knowledge of the essential principles of true religion might be preserved on the earth, and the way prepared for the revelation of a more comprehensive system to mankind. Under the divine direction, Abraham, at an early period of his life, withdrew from his country and kindred, and from the infectious influence of their superstitions; taking up his abode in the country now known by the name of Palestine, a small stripe of land along the Mediterranean, naturally sterile and rugged, but capable of extraordinary fertility through attentive culture, and commanding advantages, by its local situation, for securing an easy intercourse with the whole habitable world. In the days of Abraham, part of it was altogether unoccupied, and the rest was inhabited by different small tribes of the Canaanites, who seem to have migrated from Arabia. Among these, Abraham lived as an Emir or chief of a nomadic tribe, moving from place to place, as the increase of his flocks and the condition of his dependents required. A similar course of life was pursued by his immediate descendants, who, amidst their increasing numbers and enlarged possessions, did not depart from the habits of pastoral simplicity; so that during the period of 215 years, from the time of the arrival of Abraham till the departure of Jacob into Egypt, little progress seems to have been made in the arts of civilized life. The migration referred to, of all the descendants of Abraham, was occasioned by the well-known promotion of Joseph in the court of the king of Egypt. The Egyptians at this period were living under a regular form of government, and had made considerable advances in the arts and sciences. Policy as well as habit led them to look upon the nomadic life with an unfavourable eye; and from this circumstance, as well as from the hereditary character of offices among the Egyptians, the two races were kept entirely distinct. A separate district of the country was assigned to the Israelites, where they retained to a considerable extent the character of a pastoral tribe; the Egyptian deserts, and the neighbouring country of Arabia Petræa, affording ample opportunities for indulging in their primitive customs. The ordinary influence, however, of a more civilized and powerful people upon their dependents or allies, by degrees became perceptible; and we find the Israelites beginning to practise some of the arts of the Egyptians, and falling gradually into their idolatry. Gratitude or contempt secured the descendants of Jacob from the jealousy that their increasing numbers was calculated to awaken, till the founder of a new dynasty perceived the full extent of the danger to which his usurped dominion was exposed, and, regardless of national obligations, formed a plan for the extermination of the dangerous visitors. The rigour with which his savage plan was carried into execution, led to events by which it was frustrated, and proved the occasion of the establishment of the Israelites as a separate and independent people. Under the visible interposition of the Most High, Moses, who had been marvellously preserved from becoming the victim of the royal mandate, gave a new aspect to the destinies of the race. He led forth his countrymen from the house of their bondage, delivering to them a body of laws and institutions, which not only gave an indelible stamp to the Jewish character, but exerted an influence that continues to be experienced throughout the Christian and Mahommedan world. Like other lawgivers, he appointed religious ceremonies to be mingled with political institutions, but with this remarkable difference, that while under other systems religion is used as a means for civil security, the institutions of political society were employed by Moses to give permanency to the doctrines and practices of a pure theology.

The plan which had been entered upon by Moses for the introduction of the descendants of Abraham into the land promised to their progenitor, was carried into effect by Joshua, who succeeded to Moses; and who proceeded against the tribes which now inhabited that country, with a severity that can be condemned only by those who forget or deny the authority under which he acted, or the atrocious wickedness which warranted or called for the extremest manifestations of the divine displeasure. The command for the total destruction of the Canaanites, however, was only partially executed; and many of the evils which afterwards befell the Jewish people arose from the example of the families which had been spared with an ill-judged and presumptuous clemency. Many of the tribes also seem to have saved themselves by a timely flight, which it does not appear that the Israelites were called upon to interfere with. Procopius mentions that the peopling of Northern Africa by the Phœnicians took place in consequence of the flight of that people before the victorious Joshua.

Possession being taken of the land of Canaan, it was parcelled out among the twelve Israelitish tribes, which were to a certain extent independent of each other, though, descended from the same stock, and worshipping at the same shrine, and united by certain general interests, they formed but one nation. Their government was strictly theocratical, without, however, excluding the ordinary forms of earthly rule. During the life of Joshua, the supreme power was exercised by that individual, as it had been by Moses, under the sanction of divine appointment, with the assistance of certain ordinary magistrates. From the death of Joshua, during a period of 450 years, in the absence of a regular succession of recognised rulers, the civil constitution of the confederated tribes was fluctuating and uncertain. Their common origin and religion, the chief bonds of their union, often proved too feeble to withstand the influence of local interests and jealousies. Single tribes followed their own views, to the neglect of the common wishes or the common weal; leagues formed between two or more tribes for special purposes awakened the suspicions of their neighbours; these circumstances were aggravated by hereditary rivalries; and the government was preserved from dismemberment only by the rulers or Judges whom Providence upon great emergencies raised up to undertake the cause of the people, defending them from their enemies, or preserving them from intestine commotions.

At last the people, impatient of the uncertain government which seemed to be exerted over them, resolved upon the establishment of a monarchy, which might unite all in one peaceful kingdom. A member of the tribe of Benjamin, named Saul, was raised by common suffrage to the sovereignty, and held the sway over all the tribes of Israel about forty years. His reign was far from being either prosperous or happy; and though his bravery preserved the Israelites from external adversaries, he was deficient in that political sagacity which was necessary to consolidate the principles of the new monarchy. Upon his death, the tribes of Judah and Benjamin refused to acknowledge the authority of his son, and elected as his successor a youth named David, who had been marked out by the prophet Samuel as destined to kingly honours, and whose adventurous exploits, generous enthusiasm, and princely bearing, had endeared him to his tribe. His prudence proved equal to his valour and his piety; and in a short time he succeeded in uniting all the tribes in one kingdom, fixing his capital at Jerusalem. He was succeeded by his son Solomon, under whose reign the kingdom of Israel was carried to its highest degree of prosperity. The descendants of Abraham now formed the principal monarchy in Western Asia. From the Mediterranean Sea to the Euphrates, from the river of Egypt to Berytus, and towards the east to the Hagarenes on the Persian Gulf, all were subject to the sway of Solomon, under whose wise and peaceful rule trade flourished, commerce was extended, and the arts and sciences found patronage and protection. It often happens, that when a prince like David has settled a kingdom on solid foundations, his son is induced to indulge a taste for luxurious magnificence; and to this, as well as to his sense of religion, some have ascribed the building of the temple, the great event of his reign.

Upon the death of Solomon, the kingdom fell asunder under the feeble and impolitic sway of his son and successor Rehoboam. The causes of disunion lay deep in the character and situation of the different tribes; and, though counteracted for a time, they were ever ready to operate when occasion was afforded. The jealousy that subsisted between the twelve sons of Jacob seems to have been inherited by their descendants; but it was only among the more powerful tribes that such jealousies could lead to a dismemberment of the commonwealth. From the beginning a rivalry may be observed between the tribes of Joseph and Judah. The former inherited a double portion in the allotments to Ephraim and Manasseh, the two sons of Joseph; and their founder had been distinguished from his brethren by the blessings pronounced upon him. The tribe of Judah had the right of primogeniture, and the promised Messias was to spring from them. In this way the two tribes regarded each other with ill-concealed sentiments of hostility; and Shechem and Jerusalem, their respective capitals, were each the focus of a party ready to engage in active warfare. The impolitic exactions of Rehoboam, while they gave dissatisfaction to all his subjects, inflamed the Ephraimites to open revolt, which, fomented as it was by the ambition of Jeroboam, terminated in the establishment of a separate kingdom. This kingdom comprehended all the tribes, with the exception of the two southernmost (those of Judah and Benjamin), together with all the tributary nations as far as the Euphrates. The royal residence in the new kingdom was in Shechem, where the Mosaic ritual was superseded by a new mode of worship, and the link that bound Ephraim and Judah together finally severed.

The kingdom of Israel, as distinguished from that of Judah, had a distinct existence about 235 years, when it was invaded by Shalmaneser, who carried away the principal inhabitants into captivity. From that period all traces of the ten tribes as a distinct people are in a great measure lost. Colonists from Babylon and other eastern cities mingled with the Israelites who were left in the land of Palestine, and the mixed race were afterwards known by the name of Samaritans.

The kingdom of Judah enjoyed a somewhat longer existence than that of Israel. At last, however, about 135 years after the transference of the ten tribes to Media, the king of Babylon carried away captive the inhabitants of the land of Judah, which was left for a time wholly desert, or occupied only by wandering tribes.

During the captivity of Judah, the vanquished people seem to have enjoyed a more than usual share of the favour of their conquerors, and were considered more in the light of colonists than of captives. They were not, as they had been in Egypt, confined to a separate territory, but mingled freely with the Babylonians; being settled in thinly peopled districts, where, by a moderate degree of industry, they found an abundant sustenance. Upon the banks of the Euphrates they met some of the expatriated Israelites, who attached themselves to the tribes that had adhered to the pure worship of their fathers; and the name of *Jews*, from the larger tribe, was applied from this period to all who were recognised as the descendants of Jacob. The wisdom of many of the institutions of Moses now appeared, as they preserved the Hebrews a distinct people, notwithstanding the most intimate intercourse with another race, and secured their attachment to the great principles of monotheism in the midst of prevailing idolatry.

The captivity of the Jews continued till the year 536, when Cyrus ascended the Medo-Persian throne. This great prince had been foretold by the Jewish prophet Isaiah, as the man from whom deliverance was to come to the captive people; and in the first year of his reign he proclaimed a decree, permitting, or rather inviting, all the people of the God of Heaven, without exception, to return to Judea, and rebuild the temple of Jerusalem. About 50,000 availed themselves of this permission. They assembled at an appointed place, according to the usual mode of collecting a caravan, and proceeded under the conduct of Zerubbabel, who was nominated leader of the caravan, and governor of Judea. The return to Jerusalem took place about the close of the first year of Cyrus, after seventy years of captivity.

The building of a new temple, and the rebuilding and fortifying the city, were the two national objects which the restored captives had most at heart; and in the second year of their return the foundation of a new temple was laid. The jealousies and enmities, however, of the colonists at Samaria presented obstacles to the advancement of the work, and for a time it seems to have been abandoned. This lukewarmness on the part of the people called forth the indignant expostulations of the prophets Haggai and Zechariah, which were attended with such effect, that, by the joint application of Zerubbabel the governor, and Jeshua the son of Josedek the priest, the original decree of Cyrus was renewed by Darius, one of his successors, and the temple was finished without farther interruption. The obstacles towards restoring the city of Jerusalem were not so soon overcome. The fears of the Persian government were wrought upon by the representations of the Samaritans, as to the danger of the defection of the Jews if their city were again fortified; and thus, though Ezra was allowed by Artaxerxes Longimanus to take with him to Jerusalem as many of the Jews of Chaldea as were disposed to return, his powers, though considerable, did not extend to the fortifying of the city. It was not till the death of Zerubbabel, about twelve years after the return of Ezra, that Nehemiah was appointed his successor as governor of Judea, with authority to repair the city and rebuild the walls. This change in the policy of the Persians towards the Jews has been ascribed to the humiliating conditions of the peace which Artaxerxes was obliged to make with the Athenians after the signal defeat of his forces by Cimon, by which conditions no Persian army was to approach within three days' march of the sea. Being thus excluded from the line of sea-coast, it became an object to the Persians to have a fortified town like Jerusalem in their interest, which, without infringing upon the treaty with the Athenians, might serve as a pass for keeping open the communication between Persia and Egypt, which latter country had been reduced

Jews. anew under the Persian yoke. The extraordinary rapidity with which Nehemiah executed the important trust committed to him, the abuses which were introduced upon his return to Persia, and the steps which he took in consequence for the restoration of the Mosaic polity, and which he completed in the reign of Darius Nothus, are set forth in the book which bears his name, which, with that of his contemporary Malachi, closes the Old Testament canon,

From the time of the return from the Babylonian captivity, a remarkable change is observable in the character of the Jews, and in the features of their policy, civil and ecclesiastical. The infliction of the judgments threatened in their sacred books for their disobedience, seems to have impressed upon their minds a deeper reverence for the institutes of their Great Lawgiver; while the fulfilment of the predictions respecting their restoration to their own country led them to direct their views to the prophecies which spoke of the whole earth being brought to acknowledge the sovereignty of the God of Jacob. Of the tendency to idolatry, accordingly, for which they had hitherto been distinguished, we find few farther traces; and it was succeeded by a scrupulous adherence to the Mosaic ritual, on the observance of which they built their hopes of the accomplishment of the divine promises to their nation under the expected Messias. This change was connected with certain alterations in their institutions, which exercised a decided influence upon the destiny of the Jewish people in succeeding times. We refer to the establishment of the national councils known by the name of the Sanhedrims, and to the introduction of the synagogue worship. The precise period of their origin cannot be ascertained, but it seems not improbable that it was almost as early as the time of the return from Babylon, though a considerable period intervened before either system was in full operation. It has been conjectured that Nehemiah, in the conduct of his government, sought the assistance of a council or senate, consisting of the most influential individuals in Jerusalem; and that, in imitation of this national council, smaller senates were formed by degrees in each separate district, conducting the affairs of the community under the authority of the great Sanhedrim. These councils were intimately connected with the synagogues. As the Mosaic law was made to extend to all the actions of civil as well as to the duties of religious life, the Scriptures became of constant reference in each community. The people assembled to hear it read and explained as a religious exercise; and as it was the statute-book of the magistrate, its true meaning and right application to the circumstances which occurred became a matter of daily consideration. This gave rise to a class of men qualified for the important office of explaining the law. Skill in this department became the great distinction to which all paid reverential homage; and the direction of the worship of the synagogue, and the conduct of the courts of law, fell under the authority of the learned doctors or scribes, in whom were united the professions of law and of divinity. This was followed by a loss of power on the part of the priests, who became little more than the ministers of the sanctuary, without any authority as leaders of the people. Such was the great change effected in the course of a few centuries after the return from the captivity. The power of the priests passed into the hands of the rabbis; and instead of the schools of the prophets, and worship on high places, we have the Sanhedrims and the synagogues. The Jews who remained between the Tigris and the Euphrates, and those also who from this period began to scatter themselves throughout Egypt, Syria, and Asia Minor, and, at a later period, over Greece and Italy, and the other parts of the western world, adopted or carried along with them the synagogue service. While their personal interests prompted them to wander over different lands, a common feeling united them all to the country promised to their fathers, and to the hopes connected with its possession. These expatriated Jews conformed themselves to the regulations prescribed from time to time by the learned doctors of Judea; they contributed to the support of the services of the temple so long as it remained; and by these means, and by avoiding all intercourse by marriage with other nations, the Jews were distinguished as a separate people over all the world, and the spirit was confirmed which has preserved them from being confounded with others even to the present time.

After the death of Nehemiah, Judea was annexed to the prefecture of Syria, the administration of Jewish affairs being left to the high priests, subject to the control, however, of the provincial rulers. In this condition the Jews continued till the overthrow of the Persian empire by Alexander the Great, when Jerusalem became subject to the power of that mighty conqueror.

Upon the death of Alexander, the peace and security which the Jews had enjoyed under the Persian dynasty were changed for scenes of bloodshed and devastation. In the wars which took place amongst the successors of Alexander, Judea, from its situation between Syria and Egypt, became alternately the prey of each. In the words of Josephus, the Jews resembled a ship tossed by a hurricane, and buffeted on both sides by the waves, while they lived in the midst of contending seas. At first their country was allotted to Laomedon, along with Cœle-Syria and Phœnicia. But the ambitious views of Ptolemy Lagus, king of Egypt, being directed to the whole of Syria, he entered Judea, and choosing the Sabbath day for the assault of Jerusalem, he met with no resistance from the inhabitants, 100,000 of whom he carried off as captives, settling them in Cyrene and Alexandria; thus laying the foundation of the Jewish colony in Alexandria, which for 400 years holds a conspicuous place in the Jewish annals. With the exception of the period when Judea was overrun by Antigonus, it continued under the power of Ptolemy, whose policy towards the Jews was wise and liberal. During the reign of this prince, Simon the Just was high priest, who, according to Jewish tradition, was the last member of the great synagogue, and in this character completed the sacred canon. Ptolemy Lagus was succeeded by Ptolemy Philadelphus as king of Egypt. Under his reign the translation of the Hebrew Scriptures into the Greek (named the Septuagint, from an idle legend as to the number of individuals employed in the work) was probably begun, though not completed till a later period. During the wars of Antiochus the Great with the Ptolemiés, the inhabitants of Judea were subjected to severe suffering. Their country was laid waste, and to which side soever victory inclined, they were equally exposed to injury. Though they had received many favours under the sway of the Ptolemies, the Jews espoused the cause of Antiochus, who showed his gratitude by lightening their burdens, by gifts towards defraying the expenses of their sacrifices, and by securing them in the peaceable observance of the rites of their religion.

A very different policy was pursued by Antiochus Epiphanes, who, in all his dealings with the Jewish people, was influenced only by his rapacity, and bigotry, and cruelty. The first act of his reign was to depose the high priest Onias, that the vacated office might be conferred upon Joshua, brother of Onias, who had bribed the king to this injustice by the promise of a large tribute, to enable him to pay which, certain privileges were conferred on him, to be employed in introducing Grecian customs among his countrymen, and in weaning them from their national pe-

Jews.

culiarities. The new high priest assumed the Grecian name of Jason, allowed the services of the temple to fall into disuse, and established a gymnasium, where, under the pretext of practising athletic exercises, the Jews were won over to heathenism. Jason was soon supplanted in his turn by his brother Menelaus, who, in like manner, made it his aim to substitute Grecian for Jewish customs. In the mean time, the attention of Antiochus was attracted towards Egypt, which he invaded with a powerful army that was everywhere victorious. While there, exaggerated reports reached him of a revolt of the Jewish people, and his arms were immediately directed against Judea. Jerusalem was taken; 80,000 of the inhabitants were sold as slaves or put to the sword; and, while he plundered the temple of all its treasures, he showed his enmity against the Jewish religion by desecrating with every abomination all that the Jews esteemed most holy. After this, he anew directed his attempts against Egypt. For a time success seemed doubtful; but the weaker party made an appeal to Rome, and the firmness of Popilius Lenas compelled Antiochus to submission and retreat.

Disappointed in his designs against Egypt, Antiochus returned to his capital, where he issued a decree commanding all the inhabitants of his empire to worship the gods of the king, and to acknowledge no religion but his. It may be doubtful whether in this edict the sovereign consulted most his rapacity or bigotry. At that time the temples were not only enriched by the offerings of the votaries, but, from the security afforded by the character of their sanctity, were the great banks of deposit; and Antiochus seems to have laid the plan for plundering the temples throughout his dominions, after suppressing their worship. Among his heathen subjects, the decree met with ready obedience. The compliance in Judea, however, was not universal, and the partial opposition which was made led to those measures of frantic severity on the part of Antiochus that awakened into life the spirit of the Maccabees, whom God raised up among their degenerate countrymen to defend his cause, and give an example to mankind.

A Grecian named Athenæus, well acquainted with all the forms of heathen worship, was sent to Jerusalem to instruct the Jews in the religion they were henceforth to observe, with full powers to enforce compliance. He dedicated the temple to Jupiter Olympus; the statue of Jupiter (the abomination of desolation spoken of by the prophet Daniel) was set up on the altar of Jehovah; and throughout all Judea idol altars were erected, upon which, under penalty of the most barbarous tortures, the Jews were compelled to offer sacrifice. Circumcision, the keeping of the Sabbath, and other observances of the ceremonial law, were made capital offences, and all the copies of the sacred books that could be found were destroyed. Groves were planted and idolatrous altars erected in every city; and at fixed periods the citizens were required to offer sacrifice, and to join in the religious processions; and officers were sent into all the towns, attended by a military force, to command obedience to the royal edict. At first they met with no opposition; but the hour of resistance was approaching. We learn from the first book of the Maccabees, that when the officers of King Antiochus, in traversing Judea, came to the city of Modin to make the people sacrifice, they commanded Mattathias, a priest of the sons of Joarib, to *come first* and fulfil the king's commandment. "Mattathias answered with a loud voice, God forbid that we should forsake the law and the ordinances: We will not hearken to the king's voice to go from our religion, either to the right or to the left. Now, when he had left speaking these words, there came one of the Jews, in the sight of all, to sacrifice on the altar which was at Modin, according to the king's commandment. Which thing, when Mattathias saw, he was inflamed with zeal, and his reins trembled, neither could he forbear to show his anger according to judgment; wherefore he ran and slew him upon the altar. Also the king's commissioner, who compelled men to sacrifice, he killed at that time, and the altar he pulled down. Thus dealt he zealously for the law of God, as Phineas did unto Zambri the son of Salom. And Mattathias cried throughout the city with a loud voice, saying, whosoever is zealous of the law, and maintaineth the covenant, let him follow me. So he and his sons fled unto the mountains, and left all that they ever had in the city."

Such was the commencement of that noble stand which Mattathias and his sons made for the religion and liberties of their country. Mattathias was the son of John, the son of Simeon, the son of Asmoneus, from whom the family had the name of *Asmonean*. Different accounts have been given of the name of *Maccabee*, by which they are more generally known. The common explanation is, that it was from the four initial letters of the words which were displayed on their banner (Mi Chamoka Baelim Jahoh, who is like unto thee among the gods, O Lord). Others conceive that it was the surname given by Mattathias to one of his sons, on account of his valiant exploits,—*the Hammerer*.

Having fled to the mountains, Mattathias was soon joined by associates from all parts of the country, who needed only a leader to animate them to resistance. Mattathias lived but a short time to direct the energies of this devoted band; but upon his death he left fit successors in his valiant sons, who, during a period of twenty-six years, maintained a war with five successive kings of Syria, which terminated in the establishment of the independence of their country. Judas Maccabeus, the third son of Mattathias, was the first who undertook the management of affairs. His successes were for a time uninterrupted. From a petty revolt, the contest soon assumed the character of a mighty war; the chosen generals of Antiochus were defeated at the head of assembled hosts; in less than three years Jerusalem was once more in the hands of the Jews, its altars repaired, its temple purified, and the sacred services restored; and, soon after the death of Antiochus, the Syrians were compelled to conclude a peace with the Maccabee.

Had the Jews been united among themselves, they might now have defied the power of their enemies. But there were many elements of disunion in this ill-fated nation. The zealous attachment to their ceremonial and traditionary law, which animated the greater part of the followers of Judas, and which was one great cause of their success, was offensive to the party which had arisen with less rigid views, and who were afterwards distinguished by the name of Sadducees; and there was a numerous party, who, having conformed to the Grecian worship, were wholly in the interest of the Syrians. The Syrians were not slow in availing themselves of these internal differences, and war again began to rage. Though deserted by many of his followers, success still attended the arms of Judas, till he was slain in a furious conflict with the flower of the army of Demetrius, which with desperate resolution he had attacked near Azotus with only eight hundred men.

Judas was succeeded in command by his brother Jonathan. He fought at first with various fortune; but the prudence and enterprising valour of which he partook in common with the whole family were crowned at last with success. In the contests for the crown of Syria between Demetrius and Alexander Balas, the alliance of Jonathan was courted by the rival parties; and he was thus enabled to make terms most favourable for Judea. But in the wars that succeeded the death of Balas, he was treacherously slain by Trypho, who, under professions of friendship, had tempted him to enter Ptolemais without a sufficient force for his protection.

Simon was now the only brother who survived of the house of Mattathias; but the fate of his family did not daunt him, and he at once accepted of the hazardous pre-eminence to which the suffrages of his countrymen called him. "Since all my brethren," said he, "are slain for Israel's sake, and I am left alone, far be it from me to spare my own life in any time of trouble, for I am no better than my brethren; doubtless, I will avenge my nation and the sanctuary, and our wives and children." The pledge thus given he soon fulfilled. With characteristic energy, he put the whole country in a posture of defence; and entering into a league with Demetrius, the rival of the perfidious Trypho, he secured such privileges for the Jews, that from this period, B. C. 143, they date their freedom from the Syrian yoke. At this time the Jews elected Simon ethnarch or prince, as well as high priest; the office to be hereditary in his family. The government of Simon was marked by vigour and wisdom. But, like the rest of his family, he was doomed to a violent death, being assassinated at an entertainment by his own son-in-law, who had entered into a plot with Antiochus king of Syria, for the extirpation of the Maccabean race. Two of his sons were murdered with him; but a third escaped to Jerusalem, where he succeeded to his father's government. This was John Hyrcanus, whose surname was derived from his valiant exploits in Hyrcania, with Demetrius king of Syria. The reign of Hyrcanus lasted thirty years, and was eminently prosperous. The kingdom of Judea was extended on every side. Samaria was reduced, and the temple on Mount Gerizim destroyed. The Idumeans were subdued, and became proselytes to the Jewish religion. A league with the Romans, which had first been sought by Judas Maccabeus, and was renewed by Simon, was now confirmed on terms most advantageous to the Jews in their relations with surrounding states; and the glory of the Asmonean princes was raised to its height.

About the time of Hyrcanus we first find mention made of the Sanhedrim or Great Council, which for a considerable period exercised a power, partly legislative and partly judicial, among the Jews. It consisted of seventy individuals, priests and men learned in the law. Some have conjectured that it owed its origin to the policy of Hyrcanus, who wished to avoid the appearance of exercising an unlimited authority, by an institution which might protect, while it seemed to limit, the new monarchy.

The sons of Hyrcanus were unworthy of the stock from which they sprung. The short reign of his eldest son Aristobulus, which lasted only a year, was darkened by monstrous crimes. By his orders his own mother was imprisoned and starved to death, and his brother Antigonus was assassinated. An agony of superstitious horror at the enormity of his guilt, terminated his miserable existence. His brother Alexander Jannæus, who succeeded him in the government, was a man of enterprising valour, but cruel, deceitful, and tyrannical. The greater part of his reign was occupied in quelling revolts among his subjects, occasioned partly by the turbulent spirit of the Pharisees, but chiefly by the oppressiveness of his own sway. Immediately before his death, which was hastened by intemperance, he urged his queen Alexandra to unite herself to the Pharisaic party, as the only means to preserve the kingdom. The policy was wise for the house of the Asmoneans, and was scrupulously followed by Alexandra. Her reign, which continued nine years, was conducted with prudence and vigour, and her kingdom preserved in tranquillity.

Upon the death of Alexandra, her two sons, Hyrcanus and Aristobulus, were both competitors for the vacant throne. Hyrcanus was deficient in all the qualities that were necessary for command, and would have yielded to his brother without opposition, had he not been urged by Antipater or Antipas (father of Herod the Great) to maintain his cause. According to Josephus, Antipas was of a noble family of Idumeans who had adopted the Jewish religion. His father had been governor of Idumea during the reigns of Alexander Jannæus and Alexandra. Antipas himself was educated in the Jewish court, where he attached himself to the interests of the eldest son, whom he looked upon as the successor to the throne. The arts of Aristobulus, who, in the prospect of his mother's death, had made himself master of several of the strongest fortresses of Judea, presented an unexpected obstacle to the hopes of the friends of Hyrcanus. The prize, however, was too important to be lost without a struggle; and Hyrcanus, under the influence of Antipas, engaged in a contest for the throne. It was continued for a considerable time with doubtful issue. At last the brothers submitted their claims to the decision of Pompey, now crowned with all the glories of the Mithridatic war. Pompey delayed from time to time pronouncing in favour of either party, till at last Aristobulus, disappointed in his hopes of the support of the Roman, took up his ground in Jerusalem, and prepared for war. Upon this Pompey marched against the Jewish capital, which, after a siege of three months, was taken by assault. Had it not been for the religious scruples of the Jews as to making resistance to the progress of the works of the enemy on the Sabbath, the fortress might have proved impregnable. The attachment of the Jews to their sacred ceremonies was strikingly evinced at this period in another respect. At the moment when the temple was taken, the priests were engaged in the daily sacrifices; and, amidst all the horrors which surrounded them, they proceeded in their solemn services unmoved, thinking it better, says Josephus, to suffer whatever came upon them at their very altars, than to omit any thing that their law required of them. The curiosity of Pompey led him to visit the whole of the sacred edifice, and he entered into the holy of holies. The sacred utensils of the temple he left untouched, and even the treasures, which amounted to two thousand talents of gold. He also gave orders for the purifying of the temple, and for the continuance of the divine service as before. He appointed Hyrcanus to the office of high priest, giving him at the same time the government of Judea, tributary to the Romans, but without the title or ensigns of royalty. The cities of Phœnicia and Cœle-Syria, which the Jews had conquered, were separated from Judea and joined to Syria, which was now made a province of the Roman empire, Judea being reduced to a subordinate principality. B. C. 63.

Aristobulus, his sons Alexander and Antigonus, and his two daughters, were carried away by Pompey as prisoners to grace his triumph, Hyrcanus being left as governor of Judea. This feeble prince was wholly under the influence of Antipater the Idumean, by whose instigation he had made the effort which gave him his present supremacy. Unfit himself to hold the reins of state, he intrusted every thing to this crafty and ambitious favourite, who appointed his own sons, Phasaelis and Herod, the one governor of Jerusalem, the other of Galilee, though both nominally under the control of Hyrcanus. Herod, at this time only twenty-five years old, commenced his government with a vigour and severity that bespoke the future tyrant. A band of robbers who infested his province were made the first victims of his cruelty; and when summoned before the Sanhedrim, who were jealous of the rising powers of Antipater and his sons, to answer for his stretch of authority, he entered the council in so menacing a form, that all, with the exception of one individual, were awed into silence. The attack which the discontented Jews were afraid to commence openly, they soon after attempted in secret, and the leading men among them entered into a plot for the destruction of the family of Antipas. The father was poisoned at an entertainment given by the high priest; and when Herod and Phasaelis escaped the snare which was laid for them, means were used to alienate from them the affections of Hyrcanus. These arts, however, were baffled by Herod, who contrived to increase his influence with the prince by marrying his grand-daughter Miriam or Mariamne. The enemies of Herod now openly espoused the cause of Antigonus, son of Aristobulus, who had lately effected his escape from Rome, and who had found a supporter of his pretensions to the Jewish throne in Pacorus, the Parthian leader. In the war which ensued, Hyrcanus, with the assistance of the sons of Antipas, was generally successful. But, under the pretence of coming to an amicable arrangement, Hyrcanus and Phasaelis were entrapped into the enemy's camp, where Phasaelis was put to death, and the barbarous punishment of cutting off the ears was inflicted upon the aged governor by his unfeeling nephew Antigonus.

The discovery of this treachery aroused the energies of the surviving brother to the uttermost. Having placed his family, and whatever of value he could collect, in Massada, a fortress on a mountain near the Dead Sea, he sailed to Italy to implore the assistance of the Romans. In all the changes which had taken place at Rome, it had been the policy of Herod to ingratiate himself with the successful party. And it is a sufficient proof of the arts and talents of this extraordinary man, that he enjoyed the favour of Julius Cæsar, and Cassius, and Mark Antony, and that he was ranked as one of the friends of Augustus and Agrippa. At the present time Antony was in power at Rome. And when Herod asked merely that the brother of Mariamne should be placed on the throne of Judea, as uniting by his descent the claims both of Hyrcanus and Aristobulus, Antony named Herod himself the king. Before the end of the year Herod was again in Judea, raised a large body of soldiers, relieved his friends at Massada, and was in readiness to take the field against Antigonus. The war continued about three years, in the course of which Jerusalem again stood a long siege. When it was at last taken, the Romans, exasperated at the obstinacy with which it had been defended, would have made a general massacre, and reduced the city to ashes, had they not been restrained by Herod, who complained that "they were going to make him king of a desert." The pusillanimity of Antigonus upon his surrender subjected him to the scorn of the Roman general, who sent him in chains to Antony, under the contemptuous name of Antigona, as if he were unworthy to bear that of a man. Antony, at the cruel but perhaps politic solicitation of Herod, gave order for his execution as a common malefactor, by the rods and axe of the lictors. With Antigonus ended the Asmonean dynasty, after it had subsisted 126 years. Josephus expatiates with a natural pride upon the merits of this illustrious house, as distinguished by their descent, by the dignity of the pontificate, and by the great exploits of their ancestors.

Upon the accession of Herod to the Jewish throne, his character began more fully to develope itself. By one of the first acts of his reign, the whole of the members of the Sanhedrim were put to death, with only two exceptions. One exception was in favour of Sameas, the individual formerly referred to as standing alone in arraigning Herod to his face. If there was any generosity in the conduct of Herod towards Sameas, he forfeits the admiration it might have excited, by his unworthy jealousy of Aristobulus, the brother of his wife Mariamne. When the popular feeling was manifested in their admiration of the rightful heir of the Asmoneans, Herod saw in him a dangerous rival to his power, and by his order the youthful high priest was put to death. The mother of Aristobulus appealed to the justice of Antony to avenge the murder of her son. Herod saw his danger, and secured his safety by the homage of a personal interview. The battle of Actium put an end to his farther hopes from Antony, and his crown and even his life were exposed to a new jeopardy. He resolved therefore once more to have recourse to the expedient of a personal interview; he presented himself before Augustus upon his arrival in Egypt; and the arts which had formerly prevailed with Roman generals were still successful. But the qualities by which he was able to attach to himself many illustrious friends, and the munificent acts and proud and princely undertakings which shed a barbaric splendour over his reign, formed no atonement for the many deeds of blood by which he had arrived at his guilty pre-eminence. His crimes, however, were not allowed to pass unpunished. He regarded not how much misery might be endured by others, that his own passions might be indulged; and in those passions his guilt found its avengers.

When he left Judea to plead his cause before Antony, he gave the extraordinary injunction, that if he were condemned, Mariamne should be put to death, to prevent the possibility of her ever being the wife of another. And during his absence at the time when he paid his court to Augustus, he gave the same instructions; his love being such, that he could not think of Mariamne but as his own; if the name of love can be applied to that combination of tyranny, and pride, and selfishness, and lust, which filled his guilty bosom. The fatal secret had been communicated to the queen during his first absence, and upon his return she upbraided him with his barbarous cruelty. The jealousy of the tyrant was awakened in a moment, and, wild with rage, he rushed upon her with his sword, asking if such a secret could have been revealed except by a lover. But the paroxysm passed away, and his suspicions were forgotten in his efforts to soothe the resentment of his injured queen. Upon his second return he found that his secret had again been disclosed; and, goaded on by the enemies of Mariamne, he issued orders for her execution. Remorse and despair now took possession of his mind. He fled from all society, and, under a complication of mental and corporeal suffering, he sunk into a state of insanity. The derangement was temporary, though traces of it were discoverable to the end of his life.

As the sons of Herod by Mariamne grew up to manhood, attempts were made to poison the mind of their father against them; and the obvious interest with which they were viewed by the Hebrew nation awakened his jealousy. After a succession of scenes, in which the tyrant and the father strove for the mastery within him, he appeared as the accuser of his own sons, first before Augustus, and then before the deputies Saturninus and Volumnius; and the sanction of the Roman authority being obtained, the unhappy brothers were strangled by the orders of the unhappier father. Macrobius has preserved a saying of Augustus upon hearing of the unnatural conduct of Herod, in allusion to the Jewish faith, "that he would rather be Herod's *sow* than his *son*." Antipater, his son by a former marriage, who had instigated the proceeding against his brothers, was himself found guilty of a plot to poison Herod. Sentence of death was immediately pronounced against him, but the tyrant's own death prevented it from being carried into effect.

Amidst the dark shades of the character of this extraordinary man, the splendid acts of his administration are not to be forgotten; the fortresses by which he sought to give security to his kingdom; the harbours he constructed; the cities he built; the magnificent palace he reared for the royal residence; and the temple which he restored to almost its original greatness. The rebuilding of the city of Samaria, the building of the city and harbour of Cæsarea, with the rebuilding of the temple, must be allowed to be monuments of a princely and patriotic mind.

Upon the death of Herod, Palestine was divided amongst his three surviving sons, Archelaus, Antipas, and Philip. Archelaus was appointed ethnarch or governor of Judea, Idumea, and Samaria, which formed the largest part of the province. Antipas was named tetrarch of Galilee, and Philip tetrarch of Trachonitis. Archelaus followed in the footsteps of his father, and being without his talents or his arts, he was deposed by Augustus in the tenth year of his reign, in consequence of repeated complaints from his subjects, and banished to Vienne in Gaul. The part of Palestine which had been under Archelaus was now reduced into the form of a Roman province, being placed under the superintendence of a Roman governor, subordinate to the prefect of Syria. No fewer than three of these subordinate governors were appointed in succession towards the close of the reign of Augustus. During the reign of Tiberius there were only two, Valerius Gratus, A. D. 16, and Pontius Pilate, A. D. 27. Pilate seems to have been the first who took up his residence at Jerusalem, those who preceded him having dwelt at Cæsarea. The condition of the Jews under the Roman governors was miserable in the extreme. The extortions of the publicans, whose office it was to collect the revenue, were excessive; and the whole of their proceeding was vexatious and oppressive. It was vain to hope for redress from the governors, whose avarice and injustice were proverbially great. The very fact of paying tribute to a heathen government was felt to be an intolerable grievance. And the Roman soldiers quartered over the whole country, though they prevented a general insurrection, yet, by their very presence, and by the ensigns of their authority, exasperated the minds of the Jewish people, and led to many tumults, and seditions, and murders. A numerous party existed in Judea, whose religious prejudices were opposed to the idea of paying taxes to a foreign power, and who cherished the vain hope of restoring the Jewish kingdom. Attempts were made by different individuals, and particularly by Judas the Gaulonite, to instigate the Jews to a general revolt, which were repressed as they arose. But the fanatical principles were widely spread, and led to excesses, to which, in no small degree, may be ascribed the final destruction of Jerusalem. The party was distinguished by the name of Zealots.

The removal of Archelaus was not connected with any act on the part of the Romans towards his brothers. Trachonitis continued under Philip till the time of his death, when it was annexed to the province of Syria. Herod Antipas continued tetrarch of Galilee till after the accession of Caligula, who, upon the discovery that he had entertained treasonous designs, deprived him of his tetrarchate, and banished him to Lyons, in Gaul.

The period at which we are now arrived is by far the most important in the Jewish annals, or rather in the annals of the world. A short time before the death of Herod the Great, Jesus Christ, the promised Messias, was born at Bethlehem, one of the cities of Benjamin. He commenced his public ministry about the 30th year of his age, and was put to death by the sentence of the Roman governor, Pontius Pilate. The circumstances connected with his life and death and resurrection belong to Christian rather than to Jewish history.

Agrippa, a grandson of Herod the Great, having ingratiated himself with the Emperor Caligula, was appointed tetrarch of Trachonitis, upon the death of his uncle Philip; and upon the banishment of Herod Antipas, the tetrarchy of Galilee was added to the dominion of Herod, and ultimately he was named king of the whole territory that had belonged to his grandfather. This prince, upon his death, left a son, also named Agrippa. He was represented to Claudius as too young to be appointed to such a kingdom, and Palestine was again placed under a Roman governor. A considerable extent of territory, however, was ultimately given to young Agrippa; but Judea and Samaria were reserved as a Roman province.

The policy of the Romans led them to give toleration to their subject provinces in all matters connected with their national worship; and, from Pompey to Tiberius, countenance was given to the celebration of the Mosaic ritual. It was otherwise with Caligula, under whose reign was laid the foundation of those dissensions between the Jews and Romans which led to the utter destruction of the Jewish polity. The insane vanity of Caligula prompted him to enforce divine honours from all his subjects, which threatened the worst consequences to the Jewish people in every part of the empire. The Jews of Alexandria were the first who suffered. By their refusal to comply with the imperial edict, a pretext was afforded to the Grecian party in the city to commence a prosecution against them. The miserable Jews resolved upon sending a deputation to Rome to implore the clemency of the emperor. This deputation was headed by Philo, the greatest of all the uninspired Jewish writers, who has left an account of his interview with Caligula, and of the uncertain respite which was granted to his fellow-citizens. The governor of Syria received orders to place the statue of the emperor in the temple of Jerusalem; but he was induced, by the spirit of calm but determined resistance threatened by the whole nation, to delay the execution of the order till he received farther instructions from the emperor. There is a difference in the account of the manner in which Caligula acted upon this occasion, by Philo and Josephus; it is certain, however, that the Jewish nation remained in a state of suspense and fear till the death of the tyrant.

The worst evils, however, endured by the Jews at this period were not directly from the emperors themselves, but from their provincial governors, who, without exception, seem to have been men insensible to the claims of justice, and actuated solely by a spirit of violence and rapacity. Gessius Florus is represented by Josephus as spoiling whole cities, and ruining entire bodies of men; as giving security to robbers and lawless men when made a sharer in their depredations; and finally, as aggravating the oppressions of the people, to instigate them to open rebellion, that he might escape the danger of a representation of his crimes being made to the emperor. It was natural for the Jewish historian to represent the revolt which terminated in the destruction of his country, as originating in the injustice of their enemies; and it must be allowed, when we contemplate the proceedings of the Romans, that if ever there was a case in which revolt was justifiable, it was in that of the Jews. It may be doubted, however, whether they can be looked upon with that generous sympathy which is always awakened by the history of a people nobly uniting in the assertion of their rights and liberties. Judea, at this period, was torn by factions, a spirit of insubordination and fanaticism, chiefly connected with views of their promised Messias, pervaded the great body of the people; and miserable as was their condition under the oppressions of the procurators, it is impossible not to perceive, in perusing the works of their own historian, that their greatest sufferings were occasioned by the unsettled and violent spirit that reigned among themselves.

The commencement of the war was connected with circumstances which took place in Cæsarea. The Syrian party in that city had been favoured by the Roman emperor, and they abused the advantage which this circumstance gave them, in provoking and harassing the Jews, till at last there was a violent collision, and the Jews were driven out of the city. The leading men among them appealed to Florus, who, instead of affording them redress, cast them into prison. The news of this indignity kindled a flame in the Jewish capital; and the excitement among the people was such as to give Florus the pretext which he had long desired, of letting loose the soldiery upon the citizens. Great cruelties were inflicted, and no distinction was made between the innocent and the guilty. The influence of Berenice, sister of Agrippa, who was in Jerusalem at the time, and the arrival of Agrippa himself from Egypt soon after, promised to restore tranquillity. They both seem to have been sincere in their efforts towards a pacification, and for a time happy results followed the soothing counsels of Agrippa. It was, however, but for a time. All over Judea there were spirits determined not to allow so favourable a pretext for war as had been afforded by Florus, to pass away; and Agrippa, soon seeing that his attempts at mediation were to be in vain, withdrew to his own kingdom, and left Jerusalem to its fate. This was in the year 66. Hitherto the people professed that it was against Florus, and not against the Romans, that they had taken up arms. The distinction would not probably have been acknowledged at Rome, and the Jews did not allow the question to be tried. Eleazar, the son of Ananias the high priest, persuaded the people to reject the offerings which were made by the emperor to the temple, and which had been received since the time of Julius Cæsar; and about the same time the fortress of Massada, near the Dead Sea, was taken, and the Roman garrison put to the sword. Allegiance to the Romans was now in effect renounced, and from this period we may date the commencement of the war.

Eleazar took possession of Aera and the temple; and receiving numerous reinforcements of Zealots or Siccarii from different parts of the country, he not only resisted the assaults of the Romans and of the soldiers of Agrippa, but soon sallied out and made himself master of the whole city. He granted a safe passage to the Jewish soldiers who were against him, and to the troops of Agrippa; but a different fate awaited the Roman garrison. They had capitulated on condition that their lives were to be spared. But the moment they yielded up their arms, the followers of Eleazar commenced an attack, and, with the exception of their leader, they were all put to the sword. This monstrous breach of treaty was on a Sabbath day; and the minds of all those who had not as yet joined in the revolt were filled with gloomy forebodings of the evils which were now inevitable. But the Jews were not the only guilty parties in the deeds which darken the annals of these dreadful times. On the same day of the massacre of the Roman garrison, the Jewish inhabitants of Cæsarea, amounting to 20,000, were put to the sword. Upon this the fire spread at once over all Judea, and an attack was simultaneously made upon the neighbouring territory of Syria. Cestius Gallus, the prefect of Syria, took immediate measures for chastising this presumption. He ordered the twelfth legion into Galilee, and soon afterwards he himself entered Judea with an army of about 10,000 men. He advanced without opposition to Jerusalem, and, from the state of parties in the city, there seems little doubt, that if he had shown common prudence, or common bravery, it would soon have been in his power. But a severer doom was in reserve for it. Cestius, to the surprise of all, in a few days raised the siege, withdrew his troops, and commenced a retreat, which the pursuit of the Jews soon changed into a general flight, in the course of which he lost more than half his army. The Jews only lost a few men.

The news of this defeat was received by Nero with such alarm, that he immediately appointed Vespasian, who was considered as the most experienced general in the empire, to quell the insurrection. Without the loss of an hour after his appointment, Vespasian despatched his son Titus to Alexandria, whence, with the sixth and tenth legions, he was to proceed to Judea. Vespasian himself advanced to Syria.

Upon the retreat of Cestius, many Jews departed from Judea, as from a foundering bark, that was soon to go down in darkness and death. The Christians, we are informed by Eusebius, about this time, also remembering the prophecies of our Lord, retired to the town of Pella to avoid the approaching calamities.

The Jews who remained in their own land were diligent in putting all their strong places in a state of defence.

Vespasian opened his first campaign in Galilee in the spring of 67. His army consisted of about 60,000 men, horse and foot, including auxiliaries. On the first assault he took and burned Gadara. He then presented himself before Jotapata, which was commanded by Josephus, who afterwards wrote the history of the war. After a siege of forty days, the town was taken and destroyed. Above 40,000 men were killed during this siege. Josephus surrendered at discretion, and continued during the remainder of the war a prisoner at large among the Romans. In his history, accordingly, of this miserable period, we have the account of an eye-witness. The fact that the capture of Jotapata was the chief event of the first season, proves that the Roman had met no unworthy foe.

In the spring of the following year, Vespasian commenced by reducing the whole of Peræa, it not being his policy to march directly upon Jerusalem. He then advanced from Cæsarea towards the south, laid waste Judea and Idumea, secured Samaria, and then drew back to Cæsarea, to be in readiness to march with all his forces against the capital itself.

Vespasian had now made all his preparations; he had occupied two seasons in clearing the whole territory round and round, that nothing might interpose to break his onset; Jerusalem itself stood like an isolated tower, against which all the engines of destruction were arrayed; the force of Rome was drawn back to Cæsarea, that it might be sent off with an irresistible shock; but at that critical moment the moving power of this machinery of desolation took another direction, and a period was given to the Jewish people to repent,—or to fill up the measure of their iniquities. Upon arriving at Cæsarea, Vespasian received intelligence which fixed his whole attention upon Rome. Nero was dead, and the fate of the empire was in balance. A more important prize than Jerusalem was now presented to his view, and, called to the purple by the voice of his soldiers, he set sail for Italy, leaving his son Titus to conclude the war.

Throughout the protracted period during which Vespasian had been devastating Judea, Jerusalem, instead of making preparations to withstand the approaching attack, was the scene of contentions so ferocious, that the advance of the Romans was longed for by the great proportion of the inhabitants, as the only earthly means for their deliverance from the terrible evils under which they were suffering. There were three factions within the walls, animated against each other with sentiments of the deadliest hate, and often engaging in actual conflict. Eleazar had seized the temple, and kept himself in strength there with 2400 men. John, the rival of Josephus, had his position in the inner court of the temple. He had a party of 6000. Simon, the son of Gioras, called Simon the assassin, occupied the upper city. His force was the largest, consisting of 10,000, and 5000 Idumeans. Such was the position of the three factions when Titus took the command, and the miseries of the siege itself scarcely exceeded what had been endured amidst the daily encounters of the Jewish soldiery. Death was become so common a spectacle, that it was viewed without emotion. The feelings of kindred were dried up; a callousness of heart seized upon all; the interest in life itself seemed to be extinguished.

At last, about the beginning of April of the year 70, the tide of war took the direction of Jerusalem; and Titus, with the Roman host, advanced from Cæsarea through Samaria, and encamped under the walls. The contending chiefs, when it was too late, entered into negociations for uniting their forces against the Romans. Their mutual hatred, however, was never laid aside, nor did they repose confidence in each other, though they fought with the valour of desperation against the common enemy.

The city was fortified by three walls of prodigious strength. The one built by Agrippa was seventeen and a half feet broad, the stones thirty-five feet long, and so compacted as not to be easily shaken by the battering rams. The walls were everywhere guarded by towers, at intervals of about 350 feet, of solid masonry, and of great height. The tower Psephina, opposite to which Titus encamped, was 122 feet high; it is said to have commanded a view of the whole territory of Judea to the border of Arabia and to the Red Sea; and there were other towers of scarcely less imposing appearance, and of equal strength. Above the whole city stood the temple, the walls of which were in no place lower than 500 feet. It covered a square of a furlong each side, and was of such strength as to be supposed impregnable. Some of the stones employed in the work were seventy feet square;—and not one of these was to be left upon another.

At first the Jews made some sallies, so vigorous as to astonish the Romans themselves. Had the parties within been united, and had the time from the commencement of the war been employed in putting the city in a state of complete defence, it might have withstood the whole Roman power for years. But the day and the hour of its overthrow had been fixed in the counsels of heaven.

After strenuous fighting for every inch of ground, two walls were successively abandoned by the Jews. But the heights of Zion, the Antonia, and the temple, still remained, which might be considered the strength of Jerusalem; and so hopeless did every attempt seem to take any of them by storm, and so paralysing were the desperate efforts of the Jews upon the Roman power, that Titus found it necessary to blockade and starve the city and garrison. The inhabitants of Jerusalem now saw their enemies "*casting a trench round about them, and compassing them round and keeping them in on every side.*" The wall, which was nearly five miles in circumference, was completed in three days. The horrors that ensued are beyond description. Even before this time the evils of famine had begun to be experienced. In the extremities of hunger, many ventured out of the city to gather herbs. Strict orders were given by Titus that such individuals should be seized upon, and an example made of them, to the terror of the besieged. Those who were found with arms were crucified, sometimes to the number of 500 in a day; and the soldiers used to expose them in mockery to those upon the walls, nailed in different postures. At last wood was awanting to place the bodies upon, and room on which to erect the crosses. When the wall was completed, there was no longer the possibility, at any risk, of finding sustenance from without, and the ravages of hunger became inconceivably great. Whole families perished. Houses were filled with dead women and children, the streets with aged men. The young had not strength to bury the dead. Many died in the attempt to give burial to others, and many repaired to the tombs to wait for death. There were no more tears seen, nor cries heard. They sat with dry eyes, and mouths drawn up into a bitter smile. A deep silence was spread over the city, forming a horrible kind of night. The only noise was from those who were engaged in the work of plunder, whose mirth it was to try their swords upon the bodies of the dead; but if any one begged them to put an end to their misery, they would not kill them. The dying turned their eyes to the temple, as if to complain to God that these wicked men were suffered to live. Everything was eaten; their girdles, the straps of their sandals, the remains of old hay, the refuse of the dunghill. Scenes still more horrible discovered the depth of dreadful meaning in the words of our Saviour: "*Behold the days are coming in which they shall say, blessed are the barren, and the wombs that never bare, and the paps that never gave suck.*" And the predictions of Moses were fulfilled even to the letter: "*The tender and delicate, which would not adventure to set the sole of her foot upon the ground for delicateness and tenderness, her eye shall be evil towards her husband, and towards her son, and towards her daughter, and towards her young one that cometh out from between her feet, and towards the children that she shall bear; for she shall eat them for want of all things secretly in the siege, and straitness wherewith thine enemy shall distress thee within thy gates.*"

The cup was now full, and "for the elect's sake the days were shortened." The fortress of Antonia, after many furious assaults, was taken and destroyed; and, on the 17th of July, Titus advanced as far as the temple, where the perpetual sacrifice ceased for want of a sufficient number to offer it. Still the Jews refused to surrender, and the works of the Romans proceeded. On the 8th of August, Titus attacked the second court of the temple. The walls could not be beat down, from the size of the stones, and the defence of the Jews prevented the scaling of the galleries. Fire was therefore set to the doors, which soon spread into the temple itself, and reduced the splendid edifice into a heap of ruins. Still the upper city held out. But at last a breach was effected, and on the 8th September the whole of Jerusalem was in the hands of the Romans, and orders were given by Titus for demolishing the city and temple.

Three forts in Judea still held out against the Romans, Herodion, Massada, and Machaeras. Two of these made a long and vigorous defence, but before the end of the year 72 Judea was in a state of entire subjugation. Contrary to the usual policy of the Romans, the territory was not shared among military colonists. All the lands were exposed to sale. In the northren districts the chief purchasers were Syrians. Individuals among the Jews themselves bought considerable properties in the south; the proceeds were reserved for the imperial treasury; and a capitation tax was imposed upon the Jewish people throughout the empire, and exacted with the most galling severity, for restoring and adorning the Roman capitol, which had been destroyed in the civil wars some time before the fall of Jerusalem.

From the time of the destruction of Jerusalem by Titus, there is no longer any connecting tie in the history of the Jewish people, except their imperishable love to the religion of their fathers. Scattered abroad in almost every country of the world, in every variety of outward condition, their fate presents matter for a subordinate chapter in the history of other nations, rather than a separate subject of history. We are presented with a mass of materials, to which the ordinary rules of historical arrangement, by epochs and by countries, do not apply. The condition of the Jews from this date varies in different kingdoms, and even in different parts of the same kingdom at the same period, and is so intimately connected with the varieties of national policy, and with local and temporary causes, that it cannot perhaps be fully understood in all its parts, except when viewed as incorporated with universal history. There are, however, a few general heads, under which the more important particulars connected with their destiny may be classed; the classification must indeed be imperfect, from the discordant and impracticable nature of the materials with which we are presented; still, however, there is one principle which gives a unity to them all. And in the absence of the definite lines which limit historical narrative in other instances, we must be more forcibly struck with the peculiarities of this singular race, among whom the want of a native country has formed a bond of connection more powerful than all the ties of country to other tribes; while the efforts made to sever them from their religion has made them cling to it with an energy that seems to have incorporated itself with the very essence of their being. The circumstances which preserved the Jews as a separate people after the termination of the temple worship, were similar to those which operated during the time of the captivity, with the addition of the rabbinical system, which was now in full operation. In whatever country a few families of Jews were collected into one place, the worship of the synagogue brought them into religious fellowship; and pride in their privileges as God's peculiar people, a principle of honour in not deserting a persecuted cause, revenge against a world from which they received so much injustice, combined with never-abandoned hopes of blessings yet in store for themselves or their children, and the magic influence of associations connected with their ancient ritual, have perpetuated the Jewish name in every country where cupidity has allured or cruelty banished any of the members of the race.

There is little that is interesting in the history of the Jews for near forty years after the destruction of their city. The ruins of Jerusalem were occupied by a Roman garrison, to prevent any attempt to rebuild it; and the tax imposed by Vespasian continued to be exacted by his immediate successors, who exhibited considerable jealousy of the Jews, and often subjected individuals among them to great hardships and indignities. Upon the whole, however, the race seems to have enjoyed considerable security; and though forbidden to approach Jerusalem, large communities were suffered to be formed in Palestine.

In the beginning of the reign of Trajan, a spirit of restlessness and sedition again began to appear among this unhappy people in all quarters of the world. When the emperor was engaged in the war with Parthia, the hereditary enmity of the Jews and Greeks in Egypt broke out in hostilities, in which were shed oceans of blood. No effective attempt seems to have been made for some time on the part of the Romans to put an end to these commotions. At last, however, Hadrian interposed, and inflicted on the miserable Jews signal punishment. About the same period, A. D. 116, the Jews of Mesopotamia, whom the victories of Trajan had subjected to the Roman instead of the Parthian sway, rose in unsuccessful rebellion against their new masters. In the following year Trajan died, and, under his successor Hadrian, the Mesopotamian Jews were again left to the sway of their ancient monarchs.

The accession of Hadrian was not likely to prove advantageous to the Jews in general, as it had accidentally been to those of Mesopotamia. He had indicated his sentiments towards them by his proceedings in Cyprus and Egypt before the death of Trajan; and when he succeeded to that prince, he issued an edict forbidding circumcision, the reading of the law, and the observance of the Sabbath; and he announced his purpose of establishing a Roman colony on the ruins of Jerusalem, and of erecting a temple to Jupiter on the place where the temple of Jehovah had stood. To this new city was to be given the name Ælia Capitolina, from his own prænomen, and from the dedication of the capital to Jupiter. For a time the Jews submitted, with ill-concealed purpose of resistance, to the authority of Hadrian. But in the year 129 we find the whole of Judea once more in a state of rebellion. The leader of this new revolt was Barchochab, which, in the Syriac, signifies the son of the star. He assumed the character of the Messias, pretending that he was the Star of Jacob foretold by Balaam, who was to deliver the Jews and subdue the Gentiles. Little is known of his previous history. According to report, he had been at one time a robber; and his conduct shows that he must have been a man thoroughly conversant with scenes of blood and rapine; while the devotedness of his followers, and the vigorous and for a time successful resistance he made to the Romans, evince him a man of talent and energy. The war against Barchochab presents a repetition of the scenes of that of Titus. Success at last declared wholly in favour of the Romans, and, about the year 134, Judea was again made desolate. About a half million fell by the sword in the course of this war, besides those who perished by fire, famine, and sickness. Those who escaped were reduced to slavery by thousands. Such as could not be thus disposed of were transported into Egypt, and Palestine was almost wholly depopulated. The Jews were now forbidden to enter Jerusalem, or even to look upon it from a distance; and the city, under the name of Ælia, was inhabited by Gentiles only, or such Christians as renounced the Jewish ceremonies.

However severe the Romans might be in the wars which they carried on against the Jews, they seem to have been ready to lay aside their resentment when the occasion passed away; and under Antoninus Pius we find the Jewish people again restored to their ancient privileges, with a prohibition merely against proselytizing. They were still excluded from Jerusalem, but they were permitted to form and to maintain considerable establishments both in Italy and in the provinces; and while they were exempted from many expensive and burdensome offices, they enjoyed municipal honours in common with other citizens. The erection of new synagogues was permitted in the principal cities; and the Jews were allowed to celebrate the solemnities of their religion without molestation.

At this period we find the eastern and western Jews divided under two great spiritual monarchies, viz. the patriarchates of Tiberias and Babylon. The origin of both is involved in considerable obscurity. In regard to the former, viz. that of Tiberias, the tradition among the Jews themselves is, that the Sanhedrim, after moving from Jerusalem, settled at Jamnia, and finally fixed their abode upon the banks of the Lake Genesareth, where their supremacy was acknowledged as of divine appointment, their chief or president exercising the authority of a spiritual head over the Jews in the provinces of the Roman empire. He was acknowledged as their patriarch or pontiff. An annual contribution was raised for him by the dispersed brethren, and his legates or apostles visited every synagogue, bearing his mandates, and deciding in all questions that were brought before them. To this new form of government a legal sanction was given by the Roman emperors, and it continued in existence till about the beginning of the fifth century. As the law was still made to extend to every moment of time, and to every variety of thought and action, with a burthensome and perplexing minuteness, and no memory could retain the multitude of statutes which were prescribed, and difficulties were constantly arising as to the duty required in new combinations of circumstances, the Jewish lawyers continued to possess an unbounded power over the consciences of the people. And as it was indispensable that all the rabbis should agree in their decisions, reference was constantly necessary to the spiritual patriarch, so long as the traditionary law was not committed to writing, and was to be found only in the living decision of the patriarch and his senate. The publication of the Talmud, though it exalted the character of the special patriarchs by whom the work was undertaken, was calculated to diminish the influence of the patriarchate. It took away the necessity of appeal from the inferior courts, by affording the means to every rabbi to give a just decision. This must be considered as the chief cause of the fall of the patriarchate of Tiberias, which took place about the beginning of the fifth century; though other circumstances contributed. The exportation of the annual tribute from Rome was prohibited by the Emperor Honorius; by a law of Theodosius the title of prophet was taken from the patriarch Gamaliel; and upon the death of that individual, though the office was not abolished, its authority being destroyed, no successor was found, and the power which had been exercised by the patriarchs passed into the hands of the rabbinical aristocracy.

The power of the patriarch of the West was of a spiritual nature; but in the East, the office corresponding to the patriarchate involved a mixture of temporal authority. The Babylonian Jews are those inhabiting between the Tigris and the Euphrates. During the wars between the Jews and Hadrian, this colony was greatly increased by fugitives from the West. In their early history, and till a considerable time after the introduction of rabbinism, the Babylonian Jews were less distinguished from the people among whom they lived than their brethren in the West. So long as the temple remained, it formed a bond of union between the two classes, as they all contributed regularly to its support. In addition to this religious tax, they paid another to the kingdom to which they belonged. A system of taxation was organized for this latter purpose, which was intrusted to a chief person among themselves, named the Resch Glutha, that is, a chief of the colonists, or, as he is usually called, Prince of the Captivity. The office of this individual was at first wholly of a temporal nature, and all that related to matters of faith and worship was regulated by the decisions of the Sanhedrim at Jerusalem. After the destruction of Jerusalem an attempt was made to throw off the dependence upon the schools of Palestine, which was frustrated for a time by the arts of the patriarch and his senate. By degrees, however, the inconvenience of a constant reference to a distant country, and the growing celebrity of the schools of Nisibis and Nahardea, enabled the Resch Glutha to establish his independence. He formed a court after the model of that at Tiberias; and, under the prevailing belief that he was the lineal descendant of David, he succeeded in establishing his claim to a spiritual, in addition to his temporal authority. He exercised a power almost despotic over the Jewish people; and, though a vassal of the king of Persia, he maintained an almost regal state. The rabbis were in complete subjection to him; and from his being able to bring his power as a temporal prince to bear upon his ecclesiastical mandates, his influence over the Jewish community was greater than that of the Nasi. From our ignorance of the state of the East beyond Persia, the extent of his dominions cannot be ascertained. His subjects consisted of shepherds, husbandmen, artisans, and merchants; of the latter many were wealthy. They do not seem to have been subjected to persecution, and, in the enjoyment of peace, the interests of learning flourished. Schools rose rapidly in different parts of his dominions; and to one of these we are indebted for the Talmud of Jerusalem, which has exercised such an influence upon the Jewish people in all succeeding times. The increasing number of the schools, and of the learned men proceeding from them, gradually lessened the influence of the Resch Glutha, though the office continued in existence till the middle of the eleventh century, when it was suppressed by the tyranny of one of the caliphs.

The establishment of Christianity as the religion of the Roman empire, the irruption of the northern nations, and the rise and progress of Mahommedanism, had all a marked influence upon the condition of the Jews. The first Christian emperors conducted themselves towards the Jewish people with a lenity and forbearance that was not always agreeable to some of their subjects. Under Constantine the right of the Jews to the privileges of Roman citizenship was fully recognised, while the rabbis had the same exemption from civil and military offices as the Christian clergy. Christians, however, were prohibited from becoming Jews, while converts from Judaism were protected from the resentment of their countrymen. Under Constantius the Jews of Palestine subjected themselves to the severity of the laws by their interference in the contests between the Arians and Athanasians. Several of their cities were destroyed, and the law of Hadrian was renewed, by which they were forbidden to approach Jerusalem. The hatred of Julian to the Christians disposed him to view their enemies the Jews with a favourable eye. He entered into a correspondence with the patriarch of Tiberias, and wrote a friendly letter to the Jewish community, in which he promised to put them again in possession of Jerusalem, and to restore their temple. At last an edict was issued for the rebuilding of the sacred structure, and instructions were given to Alypius, prefect of Syria, to carry it into effect. Jerusalem was once more filled with Jews, who assembled from all sides, emulous to give their aid in an undertaking which was to prove a new era in their history. Materials for the vast fabric were collected, and the mountain was purified from the abominations of idolatry. But when the workmen proceeded to dig for a foundation, they were surprised by a subterraneous explosion, in which some perished, while the rest took to flight in dismay. Though a difference of opinion has existed as to the character of the igneous irruption, the evidence that the work was in fact suspended is of the strongest nature, and the truth of the predictions of Scripture was fully maintained. The death of Julian prevented the renewal of the attempt, and put an end to all his schemes for the benefit of the Jewish community. His successors showed in general a tendency to favour the Jews as useful subjects, and frequently protected them from the violence of the people, though in some instances the bigotry of the more powerful prelates prompted to measures of severity. It must be added, that the blind zeal of the Jews often rendered them the just objects of the popular indignation.

Upon the division of the Roman world, the condition of the Jews in the eastern empire became less favourable than that of their brethren in the West. For a time, indeed, they continued to enjoy the rights of Roman citizens according to the law; but under Justin I. they were pronounced as belonging to the same class with heretics, and consequently disqualified for civil and military offices. The laws of Justinian were framed for persecuting them into proselytism. By the imperial edicts the duties of citizens without the honours were rigorously exacted. In mixed marriages, the education of the children was confined to the Christian parent: if the children grew up unbelievers, they were deprived of their inheritance; and in law-suits, except in cases where both parties were Jews, their testimony was inadmissible. Another law was passed by this emperor, in consequence of a division among the Jews themselves, which, had it been observed, might have been followed with serious consequences to Judaism. Upon the suppression of the patriarchate, the power which had been enjoyed by that spiritual chief was divided among the primates or chief rabbis of the separate Jewish communities. The power of the rabbis arose principally from the respect in which the Talmud was held, and from the right which they enjoyed of expounding the sacred volume. From policy or habit their instructions were conveyed in ancient Chaldaic; and as this ceased to be understood by many of their hearers, who adopted the language of the country in which they settled, a very general wish prevailed for a change in this custom, and for a translation of their Scriptures. This alarming spirit of innovation was resisted by the rabbis; and the contending parties resorted to the extraordinary expedient of referring the cause to the Christian emperor. The decision of the emperor was in favour of the rights of the people. In the edict which was issued, the fullest license was granted for reading the Scriptures in the vernacular tongue; the Mischna was declared to be of human composition merely, and full of such errors as belong to all the works of men; and the hope of the emperor was expressed that the perusal of the Scriptures in a known language might lead to the conversion of many to the Christian faith. It is probable that this intimation awakened the suspicions of the people, who do not appear to have availed themselves of the permission that was given them.

In the western empire, upon the irruption of the barbarous tribes, the Jews suffered less than their Christian neighbours. Ready to accommodate themselves to every change of circumstances in the pursuit of gain, we find them following in the rear of conquering armies, or retreating before advancing hosts, contriving in one form or other to make their harvest of traffic in both cases, and frequently growing rich amidst the general ruin. In all the kingdoms which rose up out of the ruins of ancient Rome, the Jewish people formed a part; but our information respecting them for a considerable period is far from being complete. In the absence of a literature of their own, we know of them only by ecclesiastical writers, who take notice of them chiefly as the objects of the converting zeal of the catholic church. The success of the Christian priesthood among their barbarous invaders inspired them with hopes of gaining converts among the Jews. But the circumstances of the two classes were altogether different. Among the heathen, when a prince or a successful warrior was converted to the faith, he carried along with him all his subjects, or his companions in war. But the Jews moved in masses only in matters connected with their own religion; in every other respect they were wholly independent of each other. Their conversion, therefore, could only be the effect of conviction on the part of each individual. The character of the Christian clergy did not fit them for so arduous an undertaking. Their ignorance and frequent immorality placed them at a disadvantage in regard to the Jews, who were in possession of the Old Testament Scriptures, and had arguments at command which their opponents could not answer. Besides, there were no inducements of a worldly nature at this period to influence the Jews to exchange their religion. They had no wish for the retreat of the cloister, nor did they stand in need of protection for deeds of violence and rapine. Their habits were of a description altogether different from those of the monk or brigand. The attempts of the clergy, however, were unremitted, and threats and blandishments were alternately resorted to, and the struggle was constant between Catholicism and Judaism. In the political contests between the Arians and the Catholics, the Jews, as they had done in Asia, took advantage of the divisions, naturally ranging themselves on the side of the Arians, and they found their advantage in this alliance. The Gothic tribes, however, were soon brought over to the orthodox belief, when the Jews stood opposed to the united body of Christians, till the appearance of a new religion wrought a diversion in their favour.

The rise and progress of Mahommedanism proved, upon the whole, highly advantageous to the Jewish people. Equally descendants of Abraham with the followers of the prophet, they had in so far a common cause against idolators, and against the defendants of the Christian doctrine; and this for a time made them forget the points of difference. In the new impulse given to trade by the progress of the Moslem arms, the Jews, ever awake to their own interests, took their advantage. In the wide extent of conquest, new wants were created by the advance of victorious armies, kingdoms which had long ceased to hold intercourse with each other were brought into union, and new channels of commercial intercourse were opened up; and, leaving the pursuits of agriculture, which were placed at a disadvantage by the policy of the caliphs, the Jews became the merchants by whom the business between the eastern and western world was conducted. In the court of the caliphs they were favourably received; and for centuries the whole management of the coinage was intrusted to them, from the superior accuracy and elegance with which they could execute it, and from their opportunities, by the extent and variety of their commercial relations, to give it the widest circulation, and at the same time to draw in the previous issues of other mints. Nor did they flourish only in commercial greatness. Not a few of them distinguished themselves in the walks of science and literature. They became eminent in astronomy, astrology, medicine; the principal translations by which the Arabians became acquainted with the discoveries and theories of Grecian and Roman authors were conducted by them, though their chief attention was directed to the Talmud, and to the literature connected with it.

Wherever the Moslem arms extended, we see the Jews for a time in a prosperous condition, though with various exceptions, in different countries and under different caliphs. In North Africa, in Egypt, in Persia, we find Judaism in a more favourable state than formerly; and in Spain, the Jews rose to a height almost as great as that of the Moors themselves. In that country their religion enjoyed full toleration, and the Arabico-Jewish literature forms an important chapter in the history of learning from the seventh till the twelfth century.

There is a tradition, that during this period a Jewish kingdom was established on the shores of the Caspian, named Khazar. The inhabitants of the territory consisted indiscriminately of Jews, Christians, and Moslemites, drawn to the spot by the advantages which the situation of the country presented for trade. A king of the country (740) was converted to the Jewish faith, and for some time the affairs of the nation were conducted by a Jewish prince, with the assistance of a council, whose members were of different religious persuasions. A period of only a century and a half is fixed for the succession of Jewish princes, though at a later date a considerable part of the population consisted of Jews.

About the same period a combination of circumstances proved favourable to the condition of the Jews throughout Christendom. Charlemagne protected their interests. He is said to have had a Jewish merchant always near his person, and the correspondence between that great monarch and Haroun Alraschid was under the care of a Jew.

 The immediate successors of Charlemagne followed the same line of policy. France numbered the sons of Abraham as the richest of her merchants. Their fame as physicians was also widely spread; and their intelligence and activity commended some of them to high political offices.

But a time of change was approaching; and we have now to trace a gradual decline in the Jewish character and condition, till at last we find that unhappy people trampled upon, crushed, butchered, proscribed, in almost every country in Europe. The special causes of the persecutions to which the Jews were subjected were different in different countries, and it would far exceed our limits to trace them minutely. Throughout the greater part of Europe, however, we witness the advances of a similar process. We find the Jews abhorred by the superstitious on account of their religion, envied by the powerful on account of their riches; and, amidst the contempt and injustice to which they were subjected, courting, if not meriting their fate, by crouching before and cozening their hated oppressors. In many parts of Europe they were not allowed to possess land, and were forbidden to aspire to offices of trust or honour. The injurious effects of this exclusion were soon manifest in their character and habits. Shut out from all the paths which lead to distinction, the aspiring aims of honourable ambition, and the ennobling feelings connected with the love of country became strangers to their bosoms. Their efforts were limited to the accumulation of wealth; and in the decay of commerce during the middle ages, their minds were debased by the petty details of the lower species of traffic, which was all that was now open to them. Their ambition being thus fixed upon one subject, they soon mastered all the degrading arts of accumulating gain; and, prohibited from investing their gains in the purchase of land, they found a more profitable employment of it in lending it at usurious interest to the thoughtless and extravagant. The effect of this was inevitable. At a time when commercial pursuits were held in contempt, the assistance of the Jews became indispensable to the nobles, whose hatred rose in proportion to their obligations; and, where there was the power, the temptation to cancel the debt by violence became often irresistible. The Jews had no means of resisting such injustice, and their only revenge was in the exaction of more exorbitant terms when the necessitous again had recourse to them. The meanness and injustice of which they were thus unquestionably guilty inflamed the public feeling against them, till every atrocity was considered as justifiable when directed against a Jew.

In the Germanic empire the rights which the Jews had enjoyed under the ancient Roman law were to a certain extent continued to them; and though they gradually became the objects of aversion to all classes, the imperial protection and the papal ordinances preserved them from general attack till the time of the Crusades. It was at Trêves that the suggestion was first made to the fanatical multitude proceeding under Peter the Pennyless to take possession of the Holy Land, that they should fall upon the enemies of the cross living among themselves. The choice of death or of conversion was given to the miserable Jews of that city, and only a few escaped alive from the general massacre. Fathers presented their breast to the sword after putting their own children to death, that they might be rescued from the danger of being trained up as Christians; and wives and virgins sought for refuge from the brutality of the soldiers by throwing themselves into the river with stones fastened to their bodies (1096). Similar scenes were repeated in Cologne, Mentz, Worms, and in all the cities on the Rhine; and the progress of the armies was marked by the blood of the Jews till they reached the plains of Hungary. Upon a moderate computation, not fewer than 17,000 are supposed to have perished. The minds of those who escaped were filled with consternation; and their synagogues resounded with their appeals to the justice and mercy of the God of their fathers, who seemed to have forsaken them who refused to forsake Him. Many fled to Silesia, Moravia, and Poland, where they laid the foundations of great communities. A few, however, still continued to cling to the land that had given them birth; and we find them again in sufficient numbers to excite the persecuting zeal of the second Crusaders (1146). Upon this occasion the greater part saved themselves by a timely flight. Forty years later, the Emperor Frederick gave his protection to his Jewish subjects till the tempest of the third Crusade swept past. Disastrous as the period of the Crusades was to many of the Jews in Germany, there were some of them who yet contrived to reap a golden harvest. A demand for money was created for the support of so numerous armies. Many chiefs parted with their estates to enable them to proceed with their retainers to the Holy Land; and in the transfer of property which thus took place, as well as in the trade that was occasioned by the fitting out or march of numerous hosts, many Jews accumulated great wealth.

From the time of the Crusades, the condition of the Jews in Germany continued unsettled and degraded. History is full of instances of the injustice which they suffered from the rapacity of princes, and from the tumultuous assaults of the people. From certain states and cities they were interdicted altogether. In others, however, they had a right of residence, and a particular quarter of the city was assigned to them. But the privileges conferred upon them often proved the occasion of new injuries. They were frequently expelled from the streets to which they had a legal right, in order that a sum of money might be extorted from them for permission to return to their own dwellings; the popular fury was ever ready to break out against them; and needy princes held out the threat, that unless their coffers were replenished by contributions from the Jews, an incensed populace would be let loose upon them. Upon other occasions, the necessity of their conversion was insisted upon, and they were compelled to pay large sums to avoid the misery of being forcibly baptized. Reports were continually circulated to their disadvantage. Stories were told of Christian children having been found murdered in the house of a Jew, or of their own children being prevented by cruel threats from adopting the Christian faith, or of their stealing the consecrated host to crucify afresh the Son of God. And such fabrications had the effect of subjecting the Jews to the cruelty of lawless mobs, of circumscribing their rights, and of placing their lives and fortunes at a miserable uncertainty. Enthusiasts arose, who considered themselves commissioned by Heaven to proclaim war against the unhappy people. A nobleman named Rhindfleish, in the thirteenth century, proceeded through many of the most populous towns in Germany, followed by a multitude, who destroyed whole communities. A peasant named Armleder followed a similar course (1337), till his atrocities awakened the tardy justice of the emperor, by whom he was put to death. In 1346, the Flagellants came into a collision with the Jews of Frankfort, which terminated in a battle between the other citizens and their Jewish neighbours. A few years later, the whole of Europe being desolated by a plague, in Germany it was believed that the Jews had thrown poison into the public wells. The result was terrible. At Basle the Jews were brought into a vessel on the Rhine, which was set on fire, their children being spared that they might be educated as Christians. It would be tedious to enumerate the various forms in which the Jews met their death in other cities. But from Switzerland to Silesia the land was drenched with innocent blood, and even the interference of the emperor and the pope proved long insufficient to put an end to the atrocities that were perpetrated.

Feelings of humanity, as well as the interests of his kingdom, led the Emperor Charles IV. to grant to certain states and cities privileges which they had long in vain petitioned for; and in the Golden Bull the condition of the Jews was determined in such a way as preserved them from the hazard of the massacre of whole communities, though it left them still exposed to the evils of individual oppression and injustice.

Though thus subjected to every variety of inhumanity and injustice in the German empire, they were still permitted to remain in the country; and in some states and cities considerable immunities were possessed by them. It was otherwise in France, Spain, and Britain, from which countries, after being subjected to the most galling persecution, they were ultimately driven into banishment. In France the condition of the Jews had always been more precarious than in Germany; and from the tenth century we see them gradually and rapidly declining from a learned, and influential, and powerful class of the community, to miserable outcasts; the common prey of clergy, and nobles, and burghers; and existing in a state worse than slavery itself. Even in this wretched situation, though deprived of every thing else, and denied the common rights of humanity, they were still possessed of gold. This was at once their strength and their weakness; though hated by all, all were dependent upon them; and, possessed of a large proportion of the wealth of the kingdom, they had articles of value in pawn from all classes of the community. They suffered here, as in Germany, by popular violence; and the proceedings of the princes were if possible more arbitrary and tyrannical. The archives of the kingdom, however, contain evidence of usurious extortion so monstrous as loudly to call for legal interference, though not certainly in the way in which it was actually made. The edicts which terminated in their final expulsion from the kingdom began with Philip Augustus. He issued an ordinance for the relief of those who were indebted to the Jews. According to it, all the pledges in their hands were to be restored. Among these a golden crucifix and a Gospel being found, the popular suspicion was awakened, and all the Jews of Paris were sent into banishment. The necessities, or cruelty, or superstition of succeeding kings varied the modes of Jewish persecution. Louis VIII. annulled all interest on debts due to the Jews. Under Louis IX. an edict was promulgated for the destruction of the Talmud. By other laws, Jews were forbidden to hold social intercourse with Christians; and no punishment was to be inflicted upon a Christian who killed a Jew. As in Germany, monstrous tales were spread abroad, and believed, of their sacrilege and cruelty. They were accused of throwing poison into rivers, of practising magic, of holding correspondence with infidel kings. They were proscribed, hunted down, burnt to death. Yet still they sought to live in the land that oppressed them, paid a price to live in it,—and their revenge upon their oppressors was to drain them of their gold. At last, in the latter part of the reign of Charles VI. (1594), they were commanded to quit the kingdom. This sentence was rigidly put into execution; and the greater part of the exiles withdrew to Germany, Italy, and Poland.

The time of the introduction of the Jews into England is unknown. Traces of them are discoverable before the Norman invasion; after which event a considerable addition was made to their numbers. William II. found in his Jewish subjects so great a source of profit, that he refused to allow them to become converts to Christianity. The Jews flourished accordingly under his reign; they increased in numbers and in opulence in various cities throughont the kingdom, and the greater part of Oxford is said to have belonged to them. It is somewhat remarkable, however, that their only burial-place was in London, and it was not till the time of Henry II. that they were allowed the privilege of interring their dead elsewhere. Though favoured for a time by the English monarchs, from the advantages they derived from them, the Jews became the objects of popular hatred, partly from motives of superstition, and partly from the odium that at that time was generally attached to the practice of lending money upon interest, as well as from the rigour with which this practice was exercised by them. The first general display of the public hatred was in the reign of Richard I. On the day of the coronation of this prince, some Jews, contrary to an express prohibition, were discovered as spectators of the ceremony. An attack was made upon these individuals, which terminated in a general assault upon the Jews. Their houses were plundered, and in many instances committed to the flames. Richard in vain attempted to repress the tumult, which continued to rage two days. Similar outrages ensued in Norwich, Stamford, and in several other towns. Knights who were proceeding to the Holy Land considered themselves justified in robbing the rich Jews, to aid them in their pilgrimage. And, in many cases, those who had borrowed money from their Jewish neighbours stirred up the people to a tumultuous onset, as the easiest way of cancelling their debts. In York the Jews took refuge in the castle, and made a vigorous resistance; but finding their situation hopeless, they devoted themselves to a voluntary destruction. They first destroyed everything of value that belonged to them. After this their chief with his own hands murdered his wife and five children, and then submitted to death himself. Their dead bodies were thrown over the ramparts. The example was followed by five hundred others. In the mean time, those who were indebted to the Jews proceeded to the cathedral, where the bonds were kept, and committed them to the flames. During the two following reigns, the history of England abounds in instances of the oppressions to which the Jews were subjected, and of the vast sums extorted from them by the necessities of the monarchs; though privileges were occasionally conceded to them, in such forms as insured a profitable return. The tyrannical proceedings of King John in reference to the unhappy race are well known, and in particular the anecdote of his ordering that a rich Jew of Bristol should lose a tooth daily till he paid 10,000 merks. The Jew lost seven teeth before he yielded. Their situation was in no degree improved under Henry III. Though various decrees were issued in their favour, the superstitions of the clergy and the people, and the necessities of the government, subjected them to every varied form of contumely and wrong. After the king had repeated his extortions so frequently that the Jews made the vain threat of leaving the kingdom, he sold to his brother all the Jews in his realm for 5000 merks, with full power over their persons and property. At last, in the succeeding reign (of Edward I.), an edict was issued (1290), without any known pretext afforded by their conduct, for their expulsion from the country altogether; and, after having been deprived of all their possessions, the wretched race, amidst the mockery and triumph of the common people, proceeded to the shore, and finally left the island. The exiles amounted to 15,000, or, according to others, to upwards of 16,000.

The history of the Jews in the Spanish peninsula forms one of the most interesting and affecting chapters in the strange vicissitudes of that ill-fated race. During many centuries their situation, both in Spain and Portugal, was more favourable than in any other European country. The political influence which they enjoyed with the Moslems commanded for them the respect of the Christians, if it increased their hatred; and after the decay of the Mahommedan power, their superior education, their talents for affairs, their wealth and their industry, in a country where the lower orders were sunk in the deepest degradation, while the nobles were engaged almost wholly in war, rendered them too important a class of the community to allow their rights to be rashly interfered with. The protection which they enjoyed arose in no small degree from the policy of the sovereigns, who found their Jewish subjects invaluable, not only to themselves individually in various departments, as physicians or ministers of finance, but also to the country generally, from the life which their industry gave to trade, and from the unfailing certainty with which recourse might always be had to them upon every occasion when money was required. The nobles, and even the priesthood, were by no means insensible to the latter of these advantages; and when, in some instances, the sovereigns, forgetting their true interests, prepared to make the Jews the subjects of their extortion, we find the clergy overcoming their superstitious feelings, and interfering in their behalf.

The political or rather legal position of the Jews in Spain varied in different periods, and even at the same time in different parts of the country. In the most favourable circumstances, they were considered as belonging to the king directly, and indirectly to his greater vassals; and thus they enjoyed the right of self-defence, and could claim the protection of their liege lords when unjustly attacked. In all their greater communities they had their own courts of law, which enjoyed a certain jurisdiction both in civil and criminal affairs. They could possess landed property, though many efforts were made to restrict this right, which induced them here, as in other countries, to engage in the practice of lending money upon interest. The rate of interest was fixed by the law; and we do not find charges of chicanery and extortion brought against them similar to those made against their countrymen in France, or England, or Germany. Among their other privileges, they could not be imprisoned on account of debt, and, with certain limitations, their evidence was received in courts of justice. In Portugal they enjoyed similar privileges as in Spain.

The superior character of the peninsular Jews proved that these advantages were not unworthily conferred. They held a much higher rank than in the other parts of Christendom. Not compelled to have recourse to arts that sunk them in their own esteem, they maintained a generous rivalry in the liberal use they made of the wealth which they acquired in the walks of honest industry. Their literature betokens no ordinary progress in civilization. Their acquaintance with Arabic put them in possession of all the treasures of that language. Their poets, grammarians, mathematicians, naturalists, are of no mean reputation. And their astronomers were in so great renown, that some of them were employed by Alphonso the Wise in the construction of his celebrated Tables. The study of mental science was also cultivated with no ordinary care, though the pursuits of science, whether natural or metaphysical, were ever more or less connected with their theology. Three epochs have been marked in the progress of the philosophy of the Jews of Spain. In the first, we have the endeavour to connect the discoveries of science with the doctrines contained in the Talmud, and to present the peculiarities of Judaism in a philosophic form. In the second, we find the spirit of rabbinism lording it over the efforts of philosophic genius. In the third, a contest was carried on, sometimes under the forms of philosophy, between the advocates of Judaism, and those who endeavoured by the force of argument to gain converts to the Christian faith.

The point at which the star of the fortunes of the Spanish Jews might be said to culminate, was in the thirteenth century, during the reign of Alphonso X. From that period the superstitions of the people were more bitterly directed against the unfortunate race, and in the succeeding reigns constant attempts were made to diminish their privileges, while local outbreakings of popular dislike subjected individuals and whole communities to severe suffering. Alphonso XI. though himself favourably disposed towards them, was compelled (1325) to yield in various particulars to the feeling that began to be expressed against them. In this reign they were enjoined to confine themselves to particular streets, at the greatest distance from the churches; and thenceforth particular districts were known in every city where a community existed as the Jews' Quarter. The greatest misery, however, to which they were subjected arose from attempts for their conversion. A proselytizing spirit had manifested itself in various forms from an early period. An institution was erected in Aragon in 1250, for the express purpose of training men to enter into controversy with the Jews; but, not trusting to the mere force of argument, the rabbinical writings were frequently subjected to a censorship, by which whatever was supposed to be injurious to the interests or hurtful to the feelings of churchmen was cancelled. Such instances of intolerance, however, afforded but feeble presage of the fearful hurricane that at last arose.

The attack commenced in Seville in 1391, where the minds of the citizens were inflamed by a sermon which an archbishop delivered in the cathedral. Individuals among the Jews were insulted and plundered. The attempts made by the civil authorities to restrain the popular fury increased its violence, till at last a general attack was made upon the Jews' Quarter, and of 7000 families upwards of one half were put to death, while the remainder sought for safety by a pretended conversion to Christianity. The example was followed in Cordova, Toledo, Valencia, and in all the cities where the greatest communities of the Jews were to be found. Many thousands were butchered; not a few left the kingdom, seeking for refuge in Italy, Turkey, and the states of Barbary; and it is calculated that 200,000 were forced into a profession of Christianity. The condition of these converts, or pretended converts, was truly deplorable. Subjected to the suspicions of the Christians, and to the hatred of those of their countrymen who continued stedfast to their ancient creed, many of them found their situation altogether insupportable, and became voluntary exiles. Not a few returned to the profession of Judaism, choosing rather to brave all the horrors of persecution than to submit to the odium of a suspicious apostacy.

The government showed its disposition to protect those who did not depart from the Jewish religion; several of the princes were opposed to extreme measures; and affairs began to wear a more favourable aspect. But the calm was only temporary. The sincerity of the whole of the Jewish converts, or, as they were called, the *New Christians*, began to be questioned. The honour of the church was considered as at stake; and, by the influence of Alphonso of Godeja, a bull was obtained from Pope Sixtus IV. for the institution of the inquisition, effectually to prevent a return to Judaism. The queen, the Jews, even the Cortes, resisted the introduction of this dread tribunal; but the priesthood prevailed. The tribunal was opened in Seville, and invested with full power to summon every individual suspected of secret attachment to Judaism. The unsparing energy with which it was to proceed was marked by the fact, that in a short time Seville numbered more prisoners than inhabitants; and in the course of a single year, in that city and in the immediately surrounding country, upwards of 2000 were put to death, several were imprisoned for life, and 17,000 were subjected to corporal punishment. At last a large stone building was constructed for containing a multitude

Jews.

of prisoners, combustible materials were placed around the outside of the walls, while the wretched inmates were left to perish by a slow death. Four inferior inquisitions were erected in other quarters, and each tribunal received the strictest injunctions to use every effort to preserve the church from the stain of a return to Judaism. The different signs that were supposed to indicate a secret attachment to the abjured religion were defined by law; and wherever any one of them was observed, the individual was to be brought to trial. A free pardon was offered to those who confessed their guilt, if they evinced the sincerity of their contrition by revealing the names of such as had shared with them in their deceit. The rabbis were forced, upon their oath, to declare if they knew any who secretly adhered to the hated worship. Death was the punishment of concealment. The fiercest civil war, the wildest incursion of barbarous hordes, could not have occasioned the deaths of so many innocent men, or annihilated so many sources of advantage to the kingdom. The impolicy was not less infatuated than the injustice and cruelty were monstrous.

Hitherto the persecution had been confined to those who were suspected of insincerity in their profession of the catholic faith; it was now to be extended to wider limits. The arms of Ferdinand and Isabella had been prosperous against the Moors, and the soil of Spain was freed from the infidel race. The inquisition gave the horrid promise of torturing the new Christians into sincerity, or of destroying them by death; and nothing now remained but the expulsion of the Jews to deliver the kingdom from every taint of heresy. The ambition of the crowned heads became alive to the glory and advantage of reigning over a land purified from all admixture of error, and in 1492 the order was given, that within four months every Jew should leave the country. Upon the issuing of this memorable edict, the minds of the unhappy people were filled with astonishment and horror. From the one end of Spain to the other, the voice of lamentation was lifted up. But superstition is inexorable; and the appeal to the justice or mercy of Ferdinand or his queen was alike in vain. The decree was passed, and it was not to be recalled. The Jews now acted worthy of the high character which they had sustained in Spain for nearly a thousand years. The resource of apostacy still remained; but the temptation was spurned, and the sincerity of their attachment to their faith was shown by their preferring it to everything. Upwards of 300,000 left all that was dear to them on earth, and went forth in search of lands where they might be allowed to worship the God of their fathers in peace. But misfortune continued to follow them on their path. The account of their sufferings is heart-rending; our limits permit us only to mention in general, that the richer part of them withdrew first to Portugal, where the Jewish faith had been hitherto tolerated. But the contagious influence of the proceedings in Spain extended to the sister kingdom; and the wretched exiles, after being made the objects of new forms of cruelty and injustice, were at last expelled from that kingdom also. Others, who directed their course for the states of Barbary and Morocco, were subjected to the horrors of shipwreck and pestilence; some were set ashore on desert islands by the inhuman shipowners, and some were sold as slaves. Some went to Italy, where the hardest fate of all awaited them, in the cruelty with which their own countrymen refused to receive them. Thousands lay perishing for hunger on the shore, till even the pope (Alexander VI.) interfered by a sentence of banishment against the resident Jews. But, notwithstanding all the sufferings to which they were exposed, and which so materially diminished their numbers, flourishing communities were formed by the offspring of the exiles in Barbary, Turkey, Italy; and this perhaps more than any thing else evinces how great multitudes had been sent into banishment.

In Spain there were now no professed Jews. There were still, however, many secret adherents of the proscribed faith. Of these, many were so dexterous in the concealment which they practised, as to escape every effort for their detection; and some of them were seated as judges in the very inquisition that had been instituted for their destruction. Others, however, were less successful, and against them horrible cruelties were exercised under the Emperor Charles V. and by Philip II. and III.

The policy of the Spanish government was extended also to Naples, from which city the Jews were expelled by Charles V. The example, however, was not followed in other parts of Italy. In that country, from the time of Charlemagne, the legal position of the Jews was nearly the same as it was in Germany. They were placed under the protection partly of the popes and partly of the emperors, to both of whom they were bound to do homage. Here, as elsewhere, they were chiefly engaged in money-lending and in petty traffic. Their head-quarters was Rome, but numbers of them were to be found in all the other principal cities. The conduct of the popes varied in reference to the Jews, according to their personal character. Paul IV. was the first who shut them up in a confined quarter in Rome, called the Ghetto. By other popes they were compelled to assemble regularly in a church at stated periods, where sermons were preached for their conversion. They were subjected to many other galling interferences till the time of Sextus V. who annulled most of the vexatious regulations of his predecessors, and restored them to some degree of liberty.

The changes effected upon the character and condition of the Jews by the restoration of letters, and by the movements occasioned by the reformation, were less than upon any other portion of European society. There were indeed individuals among them who made noble use of the newly-discovered art of printing, and who were distinguished in the walks of literature and philosophy. But the great proportion of the people, excluded from all share in the government of the countries in which they lived, viewed the mighty changes which were taking place without interest or advantage. The great events that were stirring other men's minds into activity, freeing them from the shackles of ancient prejudices, and opening new views of human affairs, were looked upon by the Jews as a spectacle in which they had no concern. Their spirit was even more concentrated upon their individual gains and their national hopes; and in the progress of the human mind, and in the new views that were continually opening up, they saw nothing more than the fluctuations of a wild uncertainty, that wedded them with a deeper pride to the contracted principles of their unchanging rabbinism. On the other hand, the benefit of more enlarged views that began to be entertained upon the subject of liberty, and respecting the rights of citizens, were not for a long period extended to them; and it is not till within the last fifty years that an instance has been afforded of the full concession of the privileges of citizenship to a Jew.

Still the progress of civilization was silently preparing the way for greater justice being done to this people; and their conduct, in circumstances where they were allowed scope for the development of their better qualities, tended greatly to the removal of the predjudices that existed against them. In no history have we more remarkable illustrations of the great truths, that to enslave is to degrade, and that to render men useful citizens, it is essential to bestow upon them the rights of citizens.

Upon the revolt of the Netherlands, many of the Portuguese Jews (a name applied to all the Jews of the Spanish peninsula) took refuge from the persecutions of Philip II. and III. in that country. The distinctions on account of religion were to a certain extent removed, and the Jews of Amsterdam, Rotterdam, and Antwerp, vied, in the highest qualities of commercial greatness, with the citizens of the new republic. They were afterwards joined by many of their countrymen, but of a lower order, from Germany and Poland. Offshoots from the new community in Holland grew up in circumstances scarcely less favourable in Denmark and Hamburg. The continued persecution of the new Christians in Spain drove other Jews to seek their fortune in the Spanish and other colonies in the New World. They settled in the Brazils, and in some of the West India islands, with various fortunes; but many distinguished themselves by their regularity, and enterprise, and wealth, in such a way as to produce an impression favourable to their European brethren.

The recognition of the independence of the United States in America may be marked as the epoch that secured to the Jews the prospect of their being admitted to the full privileges of citizenship, and freed them from the disabilities that had been so long considered as inseparable from their religious condition. The fundamental principle of the new republic involved the treating of the Jews upon the same terms as the other inhabitants. It was not acted upon, however, throughout all the states, till the year 1822. They are now distinguished in no respect, except their religion, from any other part of the population. They have synagogues in New York, Philadelphia, Charlestown, Richmond; and much attention is paid by them to the education of the young.

The movements in America were intimately connected with the changes which soon afterwards took place in France; and to this may in some degree be traced the new policy that was observed in that country in reference to the Jews at the beginning of the revolution. Notwithstanding the edict of exclusion by Charles V., some Portuguese Jews had been allowed by Henry II. to settle in Bordeaux and Bayonne; and at a later period, the conquest of Alsace, and other changes, added some of their communities to the French dominions. The condition of these communities was taken into consideration in 1789, without any thing, however, being done in that year. But in 1791 they were admitted to equal rights as citizens. In 1806 a sanhedrim was assembled by Bonaparte at Paris; and, upon satisfactory answers being returned to certain queries proposed to them respecting their civil institutions, and their views as citizens and subjects, a plan for the organization of the Jews throughout the empire was adopted. The abuse made of their privileges in some of the provinces of the Rhine, led subsequently to partial restrictions in regard to money lending; and an effort was made to turn their attention to agricultural pursuits. The privileges conferred by Bonaparte were not interfered with upon the restoration of the Bourbons; and, since the revolution in 1830, the Jewish rabbis, as well as the clergy of the different Christian sects, receive a stipendiary allowance from the state. Though by no means approving of such a measure, we conceive it to be worthy of remark, that the minister by whom it was proposed supported it upon the ground that they had shown themselves deserving of the patronage of the state, having, during the preceding quarter of a century, acted in such a way as to give the noblest refutation to all the slanders of their enemies.

At a national assembly held in 1796, they were declared as in every respect citizens of the Batavian republic; and the union of France with Holland led to the removal of every disability of the Dutch Jews.

In Germany little change had taken place in the condition of the Jewish inhabitants for many centuries. The diet of Frederick the Great (1750), for the regulation of his Jewish subjects, was of the most intolerant description. The severest measures were resorted to for preventing their increase beyond a fixed number. They were excluded from all civil offices, and from many departments of lucrative and honourable employment, and subjected to an unequal load of taxation. Their condition in other parts of the empire was not more favourable till towards the end of the last century. Various circumstances contributed about that period to a decided improvement. Among these, the writings and character of Moses Mendelsohn may be mentioned as having had considerable effect in elevating the character of the people in the general opinion. An edict of toleration was published by the Emperor Joseph II. The most important part of it perhaps consisted in the attention it directed, and the support which it promised, to elementary education, and to its throwing open the schools and universities of the empire to the Jews. Freedom of residence and of trade was also granted to them. They were no longer excluded from public places of amusement; and they were permitted to wear certain decorations, and might be created barons. The influence of Bonaparte was exerted for the advantage of the Jews in many parts of the German states; and from 1809 to 1813, we find ordinances issued for the melioration of their condition, admitting them to civil rights, and abolishing odious distinctions. By an act of the congress of Vienna in 1815, the diet is pledged to turn its attention to the melioration of the state of the Jews; and it may be safely affirmed that their condition has of late years been of progressive advancement. In the Rhenish provinces of Prussia, some restrictions have taken place in their privileges, by disqualifying them for certain civil offices; and, in 1822, their learned men were excluded from holding offices in schools or universities. In the free towns, commercial jealousy more than feelings of a religious nature still places the Jews in some respects at disadvantage.

In Switzerland, the privileges which the Jews enjoyed during the reign of Bonaparte have been done away. In Italy also their condition is less favourable than formerly. In the ecclesiastical states they are again shut up in the Ghetto, and 300 every Sabbath are obliged to hear a sermon for their conversion; in 1829 a proposal was made for banishing them from the dominions of the pope, which, however, has not been carried into effect.

The greatest accumulation of the Jews in any one point is in the countries of ancient Poland, now divided amongst the emperors of Russia and Austria and the king of Prussia. Their state has long continued fixed. They form the middle class between the nobles and the serfs, occupying all the common branches of traffic. The rabbinical spirit exists here in greater severity than in any other country. The Austrian emperors have shown a laudable zeal for the melioration of the condition of their Jewish subjects. The Emperor Nicholas of Russia, though his attention has been directed to the subject, has shown a less enlightened spirit.

In England the Jews again obtained a legal re-establishment under the protectorate of Cromwell, and have ever since maintained their footing. A bill for their naturalization was passed in the year 1753; but the prejudices against the measure were so strongly expressed, as to lead to its repeal in the following year. They are still excluded from civil offices, and are subjected to certain restrictions that interfere with some departments of their trade; but their rights have of late years been made the subject of discussion, with every prospect of a favourable issue.

The number of Jews at present existing cannot be accurately ascertained, but it is conjectured to amount to between five and six millions. In Asia, they are to be found on the coast of Malabar, in Persia, in Bokhara, in Mesopotamia, in Arabia, and in Palestine, and may amount to about one million. Along the whole of the northern coast of Africa they are to be met with in considerable numbers, and they are probably underrated at half a million. In Europe they have been supposed to amount to two or three millions. The Jews of Poland have been variously estimated at from a half million to four or five times that number; in Prussia, there are 200,000; in the Netherlands, 80,000; in France, 60,000; in Italy, 30,000; in Great Britain, 12,000. They are to be found in numbers gradually decreasing from this to a few hundreds, in Cracow, the Ionian Isles, Denmark, Switzerland, Sweden. In America they are estimated at 12,000.

For information as to the different sects of the Jews, their antiquities, literature, customs, and respecting the means which have been employed for their conversion to the Christian faith, we must refer the reader to other parts of this work. (D. D. D. D.)

JEZIDES, amongst the Mahommedans, a term of similar import with heretics amongst Christians. The Jezides are a numerous sect inhabiting Turkey and Persia, and so called from their head, Jezid, an Arabian prince, who slew the sons of Ali, Mahommed's father-in-law; for which reason he is reckoned a parricide, and his followers heretics. There are in Turkey and Persia many Jezides, who are of two sorts, black and white. The white are clad like Turks, and distinguished only by their shirts, which are not slit at the neck like those of others, but have a round hole to thrust their heads through. The black Jezides, though married, are the monks or religious persons of the order; and they are called Fakirs.

The Turks exact excessive taxes from the Jezides, who in their turn hate the Turks as their mortal enemies; and when, in their wrath, they curse any creature, they call it Moslemin. They are extremely ignorant, and believe both the Bible and the Koran without reading either. All the adoration they pay to God consists of some songs in honour of Jesus Christ, the virgin, Moses, and sometimes Mahommed; and it is a principal point of their religion never to speak ill of the devil, lest he should resent the injury if ever he were to come into favour with God again, which they think possible. They bury their dead in the first place they come at, rejoicing as at a festival, and celebrating the entry of the deceased into heaven. When they get wine, they drink it to excess; and it is said that they sometimes do this with a religious purpose, calling it the blood of Christ.

JEZIRA-UL-OMAR, a town of Koordistan, situated on a low sandy island in the Tigris, about three miles in circumference, and environed with mountains. It covers the greater part of the island, and is defended by a stone wall now fallen into decay. It occupies the site of the ancient Roman fortress of Bezabde.

JEZRAEL, or JEZREEL, a town in the north of Samaria, towards Mount Carmel, where stood a palace of the kings of Israel, and upon the borders of Galilee. It was said to be one of the towns of Issachar. The valley of Jezreel, situated to the north of the town, runs from west to east for ten miles, between two mountains, the one to the north, commonly called *Hermon*, near Mount Tabor, the other *Gilboa*; and it was in breadth two miles.

JHALAWAN, a territory in the western part of Persia, forming the most southerly province of Beloochistan, and bordering on Mekran and Sinde. It is a very mountainous tract, divided into districts, which furnish each its quota of troops to the chief, Mahommed Khan.

JHANSI, a considerable town of Hindustan, in the province of Allahabad, district of Bundelcund. It has a strong citadel, situated on a hill which commands the town. It has a manufactory of bows, arrows, and spears, the weapons still in use among the barbarous tribes of the country. The surrounding district is valued at L.50,000 per annum, and belongs to a Hindu chief, one of the British allies. Long. 71. 45. E. Lat. 25. 31. N.

JHANSU-JEUNG, a castle in Thibet, standing on a perpendicular rock, which, from its height, seems to be nearly impregnable. It is surrounded by a populous and well-cultivated valley, which is famous for the manufacture of woollens. Long. 89. 23. E. Lat. 28. 50. N.

JHINGWARA, a Coolee state in the province of Gujerat, and district of Chalawar, containing between 5000 and 6000 houses. It is chiefly ruled by different branches of the same family, of which that of Virajee is the most powerful. The inhabitants are mostly Coolees, who have been degraded from their original rank of rajpoots. It was formerly much larger than it is at present, and was celebrated for a temple dedicated to the sun. On the banks of the Run, near this, a large quantity of salt is prepared, which is also a source of revenue.

JHURJHOORY, a village in the dominions of Nepaul, to the south of which lies the Jhurjhoory Forest, which is about ten miles in breadth, and contains all the finest woods. It is a wretched village, consisting of a few herdsmen's huts, scattered on the south bank of the Bukkia, the bed of which is here of considerable breadth. Long. 85. 20. E. Lat. 27. 4. N.

JHYLUM, JELUM, BEHUT, or VIDUSTA, the ancient Hydaspes, a large river of Hindustan, which has its rise in the south-east corner of the valley of Cashmere, in the great Himalaya ridge of mountains. It is there called Vidusta, and passes through two lakes east and west of the town of Cashmere. It is joined, ten miles below the town, by the Little Sinde, and receives many small rivulets in its course through the valley and hills, which it enters at Baramoola; and, four miles below Moozufferabad, it receives the Kishungunga from the north; its course thus far being nearly west. From this it takes a great curve to the south, and near Jelum it is little known, the country being so excessively mountainous that few travellers ever pass that way. In its course through the hills this river is very rapid, and from 100 to 200 yards broad. It is not fordable at any season, though in many places nearly so, as men and horses cross with ease, having only fifteen or twenty yards to swim. After a course of 450 miles, it joins the Chunab at Trimmoo Ghat, eighteen miles below Jhung, and ninety-five above Moultan, in which it loses its name. These joint streams, called the Chunab or Chunha, receive the Ravee forty-eight miles lower down, near Fazilshah and Ahmedpoor, from the eastward, and pass four miles north of Moultan, retaining the name of Chunab to within seven miles of Ooch, where they are joined at Sheeneebukree by the Gharra, or joint streams of the Beyah and Sutledj, 112 miles below Moultan, and sixty miles below Buhawulpore. From this point to Mittenda Khot, where they fall into the Indus, about seventy-six miles, these five streams take the name of the Punjab. The Indus, and the Punjab, or the five rivers, run parallel to each other for this distance, which is about ten and a half miles. The whole of this space is one complete sheet of water during the rains and hot season, and appears as one river. The greatest breadth between the Jhylum and the Indus appears to be 114 miles from Attock to Jellalapore Ghat. The whole course of the Jhylum, including its windings, may be estimated to exceed 400 miles.

Jib ‖ Jidda.

JIB, the foremost sail of a ship, being a large stay-sail, extended from the outer end of the boltsprit, and prolonged by the jib-boom, towards the fore-top mast head. See Sail.

Jib-Boom, a boom run out from the extremity of the boltsprit, parallel to its length, and serving to extend the bottom of the jib, and the stay of the foretop-gallant mast. This boom, which is nothing more than a continuation of the boltsprit forward, to which it may be considered as a top-mast, is usually attached to the boltsprit by means of two large boom-irons, or by one boom-iron, and a cap on the outer end of the boltsprit; or, finally, by the cap without and a strong lashing within, instead of a boom-iron, which is generally the method of securing it in small merchant ships.

JIDDA, or Djidda, a considerable commercial town, the port of Mecca, situated on the eastern shore of the Red Sea. It is built on a slightly rising ground, the lowest side of which is washed by the sea, and extends along the shore, in its greatest length, about 1500 paces, and is about half that space in breadth. It was encompassed with a wall in 1540; but as this ancient defence has long since fallen into a state of ruin, a new wall has been constructed on the land side, by the joint labours of the inhabitants, to guard against the incursions of the Wahabees. It is in a tolerable state of repair, but is of no strength; though it is a sufficient barrier against the Arabs, who have no artillery. Watch-towers, with a few rusty guns, are erected at the distance of forty or fifty paces; a narrow ditch is carried round it to increase the means of defence; and it enjoys throughout Arabia the reputation of an impregnable fortress. At the northern extremity stands the governor's residence; and on the southern is a small castle, mounting eight or ten guns. The whole harbour is commanded by a battery, in which is mounted an immense old piece of ordnance, which carries a ball of 500 pounds, and, says Burckhardt, "is so celebrated all over the Red Sea, that the very fame of it is a protection to the port." The approach to the town by the sea is by two quays, where small boats discharge the cargoes of large ships; these last being obliged to anchor in the roadstead, about two miles from the shore. The quays being shut every evening after sun-set, all communication is prevented at night between the town and the shipping. On the land-side Jidda has two gates, the Bab-Mekka on the east side, and the Bab-el-Medina on the north. Along the area enclosed by the modern wall, and by the sea on the west, a broad piece of open ground extends the whole length of the interior wall; there is also a good deal of waste ground near the Medina gate, and on the southern extremity. The suburbs consist of miserable huts of reeds, rushes, and brushwood, inhabited by Bedouins or poor peasants and labourers, who live after the Arab fashion. The most respectable inhabitants reside near the sea, where there is a long street parallel with the shore, lined with shops, and containing many khans, exclusively frequented by merchants. Jidda is well built; the streets, though unpaved, are spacious and airy; and the houses are high, consisting mostly of two stories, with many small windows and wooden shutters, and wholly constructed of stone, mostly brought from the sea-shore, but consisting of madrepores and other marine fossils. They have generally a spacious hall at the entrance, where, at noon, the master, with all his male attendants and slaves, may be seen enjoying a siesta. No attention is paid to uniformity of architecture. Some houses are built with small, others with large square stones; sometimes the walls are entirely of stone, whilst at other times layers of plank are placed at intervals in the wall. When the walls are plastered, the dazzling white, during the glare of the sun, is extremely distressing to the eye. There are no buildings of ancient date, owing to the rapid decay of the madrepore, of which they are constructed, when it is exposed to the rain and the moist atmosphere prevalent on the shores of the Red Sea. The town contains, besides many small mosques, two of considerable size. The governor's habitation is a paltry building, as also that of the collector of the customs. The khans are, many of them, well built, and have good accommodation for the foreign merchants, whose residence they are during their short stay in the town. Water is scarce in Jidda, as in most of the Arabian towns. Several of the wells are private property, and yield their owners a considerable income. Every town of moderate size has its cisterns; but the rains not falling in sufficient abundance to afford an adequate supply to the town, the inhabitants are forced to have recourse to pools formed outside of the town in the rainy season. This water is not so good as the rain-water, which is esteemed a delicacy; and though water is everywhere found at the depth of fifteen feet, it is of a bad quality, and scarcely fit for use. There are only two wells that afford sweet water, which is wholly consumed by the rich. The poorer classes use the water supplied by the other wells, to which, being of indifferent quality, their ill health is ascribed. The town of Jidda is surrounded by a barren desert, without gardens or vegetation of any kind, except a few date-trees adjoining one of the mosques, or a few shrubs and low acacia trees. Beyond the Mecca wall, and on the road to this place, are huts inhabited by poor Bedouins, camel-drivers, and negro hadjis or pilgrims, who gain a livelihood by cutting wood in the mountains. About a mile beyond these huts, eastward of the town, is the principal burial-ground, containing the tombs of several sheiks. There are also several cemeteries within the walls.

The inhabitants of Jidda, like those of Mecca and Medina, are almost exclusively foreigners, and consist, in many cases, of rich merchants, who come on their pilgrimage to Mecca with large adventures of goods, and, not being able to settle their accounts immediately, they wait another year. In the mean time, cohabiting with Abyssinian slaves, whom they marry, and finding themselves with a family, they at last settle in the country. Every pilgrimage thus adds to the population of Jidda, as of the other Arabian towns, and recruits the waste occasioned by the surplus of the deaths over the births. The natives of Jidda are only a few families of Sherifs, who are all of the learned order, and are attached to the mosques or the courts of justice. All the others are foreigners, or their descendants. Colonies from every town and province of Hadramaut and Yemen are settled in Jidda, and maintain an intercourse with their native places. There are upwards of a hundred Indian families from Surat, and a few from Bombay; also Malays, and people from Muskat. The settlers from Egypt, Syria, Barbary, European Turkey, and Anatolia, may be still recognised in the features of their descendants. No Christians are settled in Jidda; but a few Greeks from the islands of the archipelago occasionally bring merchandise to this market from Egypt. Jews were formerly the chief brokers of the town, but they were all expelled about fifty or sixty years ago by some of the governors.

Jidda is a great emporium of maritime commerce, and well merits the Arabian appellation of Djidda, or rich, being probably richer than any town of the same size in the Turkish dominions. The inhabitants are mostly all engaged in commerce, and pursue no manufactures or trades but those of immediate necessity. They are all either sea-faring people, traders by sea, or engaged in trading with Arabia. Jidda not only derives its riches from being the port of Mecca, through which numerous bands of pilgrims pass in their journey to the holy place, but it is an entrepôt of eastern commerce, through which all the exports of India and Arabia destined for Egypt first pass. All bargains are chiefly for ready money, the bad faith of the eastern merchants not being favourable to credit. Sales and purchases are made of entire ships' cargoes in the course of half an hour, and the next day the money is paid down. Its commerce may be divided into two principal branches, namely, the coffee trade and the Indian trade. Ships laden with coffee arrive from Yemen all the year round, and dispose of their cargoes for cloths, linen stuffs, and beads, but chiefly for dollars, which they take back to their own country. The demand for Arabian coffee in European Turkey, Asia Minor, and Syria, has been in a great degree superseded, since the termination of the war in Europe, by West India coffee.

The fleets from India, from Calcutta, Surat, and Bombay, reach Jidda in the beginning of May; their cargoes of Indian goods are immediately bought up by the merchants of Jidda, or on account of Cairo merchants, who send money to Jidda for the purpose. The greater part of the merchandise is shipped for Suez, and sold at Cairo, whence it finds its way into the Mediterranean. The returns are made either in goods or in dollars and sequins, large quantities of which are carried off annually by the Indian fleet. There are several rich merchants in Jidda. Burckhardt, on whose accurate information this account is chiefly founded, mentions two merchants whose grandfathers were the original settlers, and who had each a capital of from L.150,000 to L.250,000. Several Indians, he adds, had acquired capitals nearly equal; and there were about a dozen of houses possessing from L.40,000 to L.50,000 sterling. The vessels belonging to Jidda amount to about 250. It trades by land only with Mecca and Medina. A caravan, of from sixty to a hundred camels, departs for Medina every forty or fifty days, principally with India goods and drugs, and is always augmented by a crowd of pilgrims, who wish to visit Mahommed's tomb. There is another caravan for Mecca every evening, or at least twice a week, with goods and provisions. During the pilgrimage these caravans set out regularly every evening after sun-set from the Mecca gate; also a caravan of asses, which perform the journey in fifteen or sixteen hours. It is by this caravan that letters are conveyed between the two towns. There are twenty-seven coffee-shops in Jidda, where coffee, as in most parts of Arabia, is drunk to excess, and various other shops for the sale of butter, which is a chief article of Arabian cookery; honey, oil, vinegar, fruits, dates, beans, &c.; sweet-meats, sugar-plums, bread, milk; corn, consisting of Egyptian wheat, beans, lentils, dhourra, Indian and Egyptian rice; biscuits, salt, tobacco, soap, drugs, spices, sugar, perfumery, incense, &c. There are also shops for articles of Indian manufacture, for the sale of clothes chiefly after the Turkish fashion, carpets, Indian piece goods. There are, besides, bankers, bakers, tailors, and one watch-maker. The number of inhabitants may be estimated in general at from 12,000 to 15,000; but during the months preceding the pilgrimage, and the summer months, when the Indian fleets arrive with the monsoons, the influx of strangers swells the population one half above its usual number. Long. 39. 15. E. Lat. 21. 29. N.

JIGAT POINT, a town and promontory at the south-west extremity of Gujerat, situated on the Goomty, which is an asylum for pirates, the people of this country being much addicted to piracy, in which they are encouraged by their chiefs. It has a Hindu temple dedicated to Krishna. Long. 69. 7. E. Lat. 22. 12. N.

JIHON. See OXUS.

JILLIFREY, a town of Africa, situated on the southern bank of the Gambia, near the mouth of that river. Although not the capital, it is the chief place of trade of the flourishing little kingdom of Barra; and the king has here a custom-house, by which duties on vessels passing up and down the river are levied. Long. 16. 7. W. Lat. 13. 16. N.

JIN. See GENII.

JIONPOOR, or JOANPORE, a district of Hindustan, in the province of Allahabad, included principally between the twenty-fifth and twenty-sixth degrees of north latitude. It is situated between the river Gogra on the east, and the Ganges on the south; to the north it is bounded by the Gogra and part of Oude; and on the west it has the nabob of Oude's territories. It is well watered, and extremely fertile; and the soil is under good cultivation, and well covered with wood. The inhabitants are Mahommedans and Hindus, in nearly equal proportions. Of the Hindus there was one tribe amongst whom the practice of female infanticide greatly prevailed; but, by the humane influence of the British government, it has been in a great measure abolished. This district came into the possession of the British in 1775, as forming part of the Benares zemindary. The principal towns are Jionpoor, Gazypoor, and Azimgar.

JIONPOOR, the chief town in the above district, and formerly the capital of an independent principality. It is situated upon the banks of the Goomty. The fort, which is built of solid stone-work, was founded in 1370, by Sultan Feroze III. of Delhi, and named after his uncle and predecessor, whose name was Joana. He ordered a Hindu temple to be levelled, and erected the fort around the ruins of it. After his return to the capital, he collected numerous artificers, and persons of every description, and sent them to inhabit the new city, which was completed in twelve years. On the subversion of the empire of Delhi by Timour or Tamerlane, Khuaje Jehan, a governor of the eastern districts, assumed the royal dignity, and he made Jionpoor his capital. He was succeeded in 1399 by his son Mobarik Shah, whose successor was Sultan Ibrahim. During his prosperous reign of forty years he spared no expense to strengthen and improve the fortress and city, and Jionpoor became one of the most celebrated cities of Hindustan, famed for religion and learning. Jionpoor was again annexed to the empire of Delhi in the year 1478, when the reigning prince was overthrown. Many of the mosques, and some of the caravanserais and colleges built at that period, are still in existence. The fortress is built upon a high bank of the river Goomty, so named from its meandering course. It is built of solid stone, and rises considerably above the level of the surrounding country. It was frequently taken in the contests between the Afghans and the Moguls, and much dilapidated; but about the year 1570 it was thoroughly repaired by a nobleman from the court of Akbar, who was governor of Bengal. It was also during his time that the celebrated bridge of Jionpoor was built, which has now stood 250 years, and still remains a monument of ancient magnificence and of architectural skill. In 1773, when this bridge was submerged during the rainy season, a brigade of British troops sailed over it. Such is the strength and solid construction of this bridge, that it suffered no damage from the violence of the current. The town surrounds the fort on three sides, and contains a good bazar and a number of brick houses. The surrounding country for several miles is covered with the ruins of tombs and mosques. Of the latter there are several in a good state of repair, namely, the Jamai Musjed, which is very handsome, and is built of stone. The travelling distance from Benares is forty-two miles, and from Lucknow 147 miles. Long. 82. 39. E. Lat. 25. 45. N.

JOAB, general of the army of King David, who defeated the Syrians and the other enemies of David, and took from the Jebusites the fort of Zion, considered by them as impregnable. He also signalized himself in all David's wars, but was guilty of basely murdering Abner and Amasa. He procured a reconciliation between Absalom and David; and afterwards slew Absalom, contrary to the express orders of the king. He at length joined Adonijah's party, and was put to death by the order of Solomon, in the year before Christ 1014.

JOACHIMITES, in *Ecclesiastical History*, the disciples of Joachim, a Cistertian monk, who was abbot of Flora in Calabria, and a great pretender to inspiration.

The Joachimites were particularly enamoured of certain ternaries. The Father, they said, operated from the beginning till the coming of the Son; the Son, from that time till their own era, which was the year 1260; and from the latter epoch the Holy Spirit was to operate in his turn. They also divided every thing relating to men, to doctrine, and to the manner of living, into three classes, according to the three persons in the Trinity. The first ternary consisted of men, the first class of whom was that of married men, which had lasted during the whole period of the Father; the second was that of clerks, which had lasted during the time of the Son; and the third was that of the monks, in which there was to be an uncommon effusion of grace by the Holy Spirit. The second ternary was that of doctrine, namely, the Old Testament, the New Testament, and the everlasting Gospel; the first of which they ascribed to the Father, the second to the Son, and the third to the Holy Spirit. A third ternary consisted in the manner of living, viz. under the Father, men lived according to the flesh; under the Son, they lived according to the flesh and the spirit; and under the Holy Ghost, they were to live according to the spirit only.

JOAG, a town of Western Africa, and capital of the kingdom of Kajaago. See KAJAAGO.

JOAL, a sea-port on the western coast of Africa, in the small kingdom of Bar-Sin. Formerly a considerable slave trade was carried on here; but cattle, poultry, and other provisions are what it now chiefly supplies. Very large vessels, however, cannot enter the port, on account of a sand-bank which stretches across the mouth of the harbour.

JOAN, POPE, called by Platina, John VIII., a woman said to have occupied the holy see between Leo IV. who died in 855, and Benedict III. who died in 858. Marianus Scotus says that she occupied the pontifical chair two years five months and four days. Numberless have been the controversies, fables, and conjectures, respecting this pope. It is said that a German girl, pretending to be a man, went to Athens, where she made great progress in the sciences; and that she afterwards repaired to Rome, still indued with the male habit. As she had a quick genius, and spoke with a good grace in the public disputations and lectures of the time, her great learning was admired, and every one loved her extremely; so that after the death of Leo, she was chosen pope, and performed all offices as such. But whilst she was in possession of this high dignity, she became pregnant; and as she was going in a solemn procession to the Lateran church, she was delivered of a child, between the Coliseum and St Clement's church, in a public street, before a crowd of people, and died on the spot, in 857. By way of embellishing this story, it has been alleged that precautions were afterwards taken to prevent the recurrence of a similar accident.

JOAN *d'Arc*, commonly called the Maid of Orleans, whose heroic behaviour, in re-animating the expiring valour of the French nation, deserved a better fate. To accomplish this object, she pretended to be inspired; and, in her character of prophetess as well as heroine, succeeded in infusing new energy into her countrymen. But her enemies were not deceived as to her real character; they regarded her merely as a bold and successful impostor; and accordingly, when she fell into their hands, they put her to death. She was burned by the English as a sorceress in 1421, at the age of twenty-four. See FRANCE.

JOANA, a town on the northern coast of the island of Java, formerly fortified. It is situated a few miles inland, on the river Joana, along which it extends about a mile. The surrounding country yields rice, timber, and the natives are employed in spinning cotton. The river on which the town is situated is the longest and deepest in the country. It flows out of a deep lake, to which it is navigable by boats; and it has several branches, one of which communicates with Samarang.

JOANES, Dos, a large island of South America, situated at the mouth of the river Amazons, in the province of Para. It is separated from the mainland west of the river Toccantins by the Strait of Tagyparu on the south, and extends ninety miles from north to south, and one hundred and twenty from east to west. It is one of the best peopled districts in the province; and, from its extensive grazing farms, Para, the capital, which is opposite to it, draws its chief supply of meat. The island contains many small towns and villages, and a considerable population of all castes and shades; but the Indians, who are very imperfectly civilized, are the most numerous. The climate is hot, but tempered by the ocean breeze.

JOAO DEL REY, a town of Brazil, in the extensive country of Minas Geraes. It is surrounded by mountains, and lies partly on the side of an eminence and partly on a plain, being divided into two by the small river Tijuco. The town is compact, of a circular form, and has the general appearance of all Portuguese towns of the same class. The houses are low, white-washed, and furnished with latticed windows. The streets are narrow, crooked, far from uniform, and very slippery, being paved with large, smooth, blue stones, with a channel in the middle. The site of the buildings is so irregular, that they overtop each other, the conspicuous points being selected for public offices and the best private dwellings. The government-house is a large, substantial building, well situated for observing what passes in the town, and for the despatch of public business. Adjoining to it are the public offices, which form one side of an unfinished square; on the other stand some plain, substantial houses; and in the centre, the pillar of public executions, surmounted by a figure of Minerva, invested with the insignia of justice. The jail, a large and strong building, is situated in the principal street. There are thirteen churches, amongst which is a sort of metropolitan church, built in taipé or paysan. Its exterior is mean, but it contains within some very remarkable ornaments. A brisk trade is carried on between this town and the capital, by means of caravans, conveying thither bacon, cheese, some cottons, woollen hats, horned cattle, mules, and gold bars, and bringing back in return European goods, chiefly Portuguese and English, such as calicoes, handkerchiefs, lace, iron-ware, wine, porter, and liqueurs. Though the environs are very mountainous and bare, and seem to be thinly peopled, yet, in the clefts of the mountains and valleys many *haciendas* are scattered, which furnish the necessary supplies of maize, mandioc, beans, oranges, tobacco, a small quantity of sugar and cotton, cheese in abundance, cattle, swine, and mules; whilst the streams, which are full of fish, contribute to the supply of food. Formerly the chief occupation of the people was searching for gold. The mine to which the town owes its origin and celebrity, and whence such masses of mineral wealth have been extracted, is situated within the town, near the government-house. It is nothing but a deep pit, having perpendicular sides, and always full of water during the rainy season. The labour and expense of procuring the precious metal under such circumstances, together with the ignorance of the mechanical arts here, present insuperable obstacles to the full produce of the mine being obtained, and the greater part of the gold dust brought to the smelting-house comes from other quarters. The lower classes in this town are idle and profligate; a social condition which in some measure may be ascribed to the general want of education amongst the inhabitants. The town is governed by a *desembargador*, or supreme judge. It has also an attorney-general, a vicar, and a royal Latin professor. The population amounts to about 6000, of which only one third are white people, the rest being negroes and mulattoes. The colour of the white people constitutes an exemption from toil; and those who do labour, occupy themselves on farms, in superintending shops, or in filling places of public trust, and in discharging the duties of religion and justice. Others are employed at woollen manufactories in the neighbourhood, the cloth being prepared from an article of native produce. This town is stated to be eighty miles south-west of Villa Rica, about the same distance south-south-west of Sabara, and upwards of two hundred miles north-west of Rio.

JOB, or *Book of* JOB, a canonical book of the Old Testament, containing a narrative of a series of misfortunes which happened to a man whose name was Job, as a trial of his virtue and patience; together with the conferences which he had with his friends on the subject of his misfortunes, and the manner in which he was restored to ease and happiness. This book is filled with those noble, and elevated, and figurative expressions, which constitute the essence of poetry.

Many of the Jewish rabbin pretend that this relation is altogether fictitious; and others think it a simple narrative of a matter of fact just as it happened; whilst a third class of critics acknowledge that the groundwork of the story is true, but that it is written in a poetical strain, and decorated with peculiar circumstances, to render the narrative more profitable as well as entertaining. The time in which Job lived is not mentioned. It has been thought that he was much more ancient than Moses, because the law is never cited by Job or his friends, and because it is related that Job himself offered sacrifices. Some imagine that this book was written by himself; others are of opinion that Job wrote it originally in Syriac or Arabic, and that Moses translated it into Hebrew; but the rabbin generally held that Moses was the author of it, and many Christian writers are of the same opinion.

JOBBER, a person who undertakes jobs, or small pieces of work. In some statutes, jobber is used to signify a person who buys and sells for others. See BROKER.

JOBBING, the business of a jobber.

*Stock-*JOBBING denotes the practice of trafficking in the public funds, or of buying and selling stock with a view to its rise or fall. The term is commonly applied to the illegal practice of buying and selling stock for time, or of accounting for the differences in the rise or fall of any particular stock for a stipulated time, whether the buyer or seller be possessed of any such real stock or not.

JOCKEY, in the management of horses, the person who grooms or rides them. See, on this subject, HORSE and HORSEMANSHIP.

JOEL, or *the Prophecy of* JOEL, a canonical book of the Old Testament. Joel was the son of Pethuel, and the second of the twelve lesser prophets. The style of this prophet is bold, figurative, and expressive. He upbraids the Israelites for their idolatry, and foretells the calamities which they should suffer as the punishment of that sin; but he endeavours to support them with the comfort that their miseries would have an end upon their reformation and repentance. Some writers, inferring the order of time in which the minor prophets lived from the order in which they are placed in the Hebrew copies, conclude that Joel prophecied before Amos, who was contemporary with Uzziah, king of Judah. Archbishop Usher draws this inference from Joel's foretelling the drought (chap. iv. 7, 8, 9). But if we consider the main design of Joel's prophecy, we shall be apt to conclude that it was uttered after the captivity of the ten tribes; for he directs his discourse to Judah alone, and speaks distinctly of the sacrifices and oblations which were daily offered in the temple.

JOGHIS, a sect of religious persons in the East Indies, who never marry, nor hold any private property, but live on alms, and practise strange severities or mortifications. They are subject to a general, who sends them from one country to another to preach. They are, properly, a kind of penitent pilgrims, and supposed to be a remnant of the ancient Gymnosophists. They principally frequent such places as are consecrated by the devotion of the people, and pretend to live several days together without either eating or drinking. After having gone through a course of discipline for a certain time, they look upon themselves as impeccable, and privileged to do any thing; in consequence of which they give a loose rein to their passions, and run into all manner of debauchery.

JOGUES, or YUGS, certain ages, eras, or periods of extraordinary length in the fabulous chronology of the Hindus. They are (see Halhed's *Preface to the Code of Gentoo Laws*, p. xxxvi.) four in number, viz.

1. The Suttee Yug, or age of purity, which is said to have lasted three millions two hundred thousand years; and they hold that the life of man was extended in that age to one hundred thousand years, and that his stature was twenty-one cubits.

2. The Tirtah Yug, in which one third of mankind was corrupted, they suppose to have consisted of two millions four hundred thousand years, during which men lived to the age of ten thousand years.

3. The Dwapaar Yug, in which half of the human race became depraved, endured one million six hundred thousand years, during which the life of man was reduced to a thousand years.

4. The Collee Yug, in which all mankind were corrupted, or rather lessened (for that is the true meaning of the word *Collee*), is the present era, which they suppose ordained to subsist four hundred thousand years, and of which nearly five thousand are already past. The life of man in this period is limited to one hundred years.

Some account has already been given of the Indian chronology (see articles CHRONOLOGY and HINDUSTAN), and it is therefore unnecessary to recur to the subject in this place. But we may nevertheless subjoin Dr Robertson's observations on the above periods, from the Notes to his *Historical Disquisition concerning India*. "If," says he, "we suppose the computation of time in the Indian chronology to be made by solar, or even by lunar years, nothing can be more extravagant in itself, or more repugnant to our mode of calculating the duration of the world, founded on sacred and infallible authority. From one circumstance, however, which merits attention, we may conclude that the information which we have hitherto received concerning the chronology of the Hindus is very incorrect. We have, as far as I know, only five original accounts of the different Jogues or eras of the Hindus. The first is given by M. Rogers, who received it from the Brahmins on the Coromandel coast. According to it, the Suttee Jogue is a period of one million seven hundred and twenty-eight thousand years; the Tirtah Jogue is one million two hundred and ninety-six thousand years; the Dwapaar Jogue is eight hundred and sixty-four thousand. The duration of the Collee Jogue he does not specify (*Porte Ouverte*, p. 179). The next is that of M. Bernier, who received it from the Brahmins of Benares. According to him, the duration of the Suttee Jogue was two millions five hundred thousand years; that of the Tirtah Jogue, one million two hundred thousand years; that of the Dwapaar Jogue is eight hundred and sixty-four thousand years. Concerning the period of the Collee Jogue he is likewise silent (*Voyages*, tom. ii. p. 160). The third is that of Colonel Dow; according to which the Suttee Jogue is a period of fourteen millions of years, the Tirtah Jogue one million and eighty thousand, the Dwapaar Jogue seventy-two thousand, and the Collee Jogue thirty-six thousand years (*Hist. of Hindost.* vol. i. p. 2). The fourth account is that of M. le Gentil, who received it from the Brahmins of the Coromandel coast; and as his information was acquired in the same part of India, and derived from the same source, with that of M. Rogers, it agrees with his in every particular (*Mém. de l'Académie des Sciences pour* 1772, tom. ii. part i. p. 176). The fifth is the account of Mr Halhed, which has been already given. From this discrepancy, not only of the total numbers, but of many of the articles in the different accounts, it is manifest that our information concerning Indian chronology is hitherto as uncertain as the whole system of it is wild and fabulous. To me it appears highly probable, that when we understand more thoroughly the principles upon which the factitious eras or jogues of the Hindus have been formed, that we may be more able to reconcile their chronology to the true mode of computing time, founded on the authority of the Old Testament; and may likewise find reason to conclude, that the account given by their astronomers, of the situation of the heavenly bodies at the beginning of the Collee Jogue, is not established by actual observation, but the result of a retrospective calculation."

JOHANNA, or ANJOUAN, more properly Hinzouan. See HINZOUAN.

JOHANN-GEORGENSTADT, a city of the mining district of the kingdom of Saxony, in the circle of Freyburg, upon the frontiers of Bohemia. It contains 396 houses, and 3000 inhabitants, who are employed in extracting silver, tin, vitriol, sulphur, iron, and manganese, from the surrounding mines.

JOHANNISBERG, a town of the duchy of Nassau, in Germany, near the Rhine, containing about 700 inhabitants. It is celebrated for its wine. The most famous of the vineyards belonged formerly to the prince-bishop of Fulda, but now to Prince Metternich, who has a castle at the town, and is said to derive from his wine an income of L.4000 per annum. There is much other wine produced from the neighbourhood, of an excellent quality; but it is estimated lower than that of the prince.

JOHN, ST, the Baptist, the forerunner of Jesus Christ, was the son of Zacharias and Elizabeth. He retired into a desert, where he lived on locusts and wild honey; and about the year 29 began to preach repentance, and to declare the coming of the Messiah. He baptized his disciples, and the following year Christ himself was baptized by him in the river Jordan. Some time afterwards, having reproved Herod Antipas, who carried on a criminal correspondence with Herodias, his brother Philip's wife, he was cast into prison, where he was beheaded. His head was brought to Herodias, who, according to St Jerome, to revenge herself after his death for the freedom of his reproofs, pierced his tongue with the bodkin with which she used to fasten her hair.

JOHN, *St*, the Apostle or Evangelist, was the brother of St James the Great, and the son of Zebedee. He quitted the business of fishing to follow Jesus, and became his beloved disciple. He was witness to the actions and miracles of his Master, was present at his transfiguration on Mount Tabor, and attended him in the garden of olives. He was the only apostle who followed him to the cross, and to him Jesus left the care of his mother. He was also the first apostle who knew him again after his resurrection. He preached the faith in Asia, and principally resided at Ephesus, where he maintained the mother of our Lord. He is believed to have founded the churches of Smyrna, Pergamus, Thyatira, Sardis, Philadelphia, and Laodicea. He is also said to have preached the gospel amongst the Parthanis, and to have addressed his first epistle to that people. It is related that, when he was at Rome, the Emperor Domitian caused him to be thrown into a caldron of boiling oil, but that he came out unhurt; upon which he was banished to the isle of Patmos, where he wrote his Apocalypse. After the death of Domitian he returned to Ephesus, where he composed his Gospel, about the year 96; and died there, in the reign of Trajan, about the year 100, at the age of 94.

Gospel of St JOHN, a canonical book of the New Testament, containing a recital of the life, actions, doctrine, and death, of our Saviour Jesus Christ, written by St John the apostle and evangelist. At the desire of the Christians of Asia, St John wrote his Gospel at Ephesus, after his return from the isle of Patmos. St Jerome says he would not undertake it, except upon condition that they should appoint a public fast to implore the assistance of God; and that, the fast being ended, St John, filled with the Holy Ghost, broke out into the words, "In the beginning was the Word," &c. The ancients assign two reasons for this undertaking. The first is, because, in the other three Gospels, there was wanting the history of the beginning of Jesus Christ's preaching till the imprisonment of John the Baptist, which therefore he applied himself particularly to relate. The second is, that it was written in order to remove the errors of the Cerinthians, Ebionites, and other sects. But Mr Lampe and Dr Lardner have urged several reasons to show that St John in his Gospel did not write against Cerinthus, or any other heretic.

Revelation of St JOHN. See APOCALYPSE.

JOHN, *St*, the name of several small towns, counties, rivers, lakes, bays, creeks, and capes of North and South America, all of which deserving of particular notice will be found described under the heads of the various states or provinces where they occur.

JOHN *of Salisbury*, bishop of Chartres, in France, was born at Salisbury, in Wiltshire, in the beginning of the twelfth century. Where he received the rudiments of his education is unknown; but we learn, that in the year 1136, being then a youth, he was sent to Paris, where he studied under several eminent professors, and acquired considerable reputation for his application and proficiency in rhetoric, poetry, divinity, and particularly in the learned languages. From Paris he travelled into Italy; and, during his residence at Rome, he rose into high favour with Pope Eugenius III. and his successor Adrian IV. After his return to England, he became the intimate friend and companion of the renowned Thomas-a-Beeket, archbishop of Canterbury, whom he attended in his exile; and he is said to have been present when that haughty prelate was murdered in his cathedral. What preferment he obtained in the church during this time does not appear; but in 1176 he was promoted by King Henry II. to the bishopric of Chartres in France, where he died in 1182. This John of Salisbury was one of the first restorers of the Greek and Latin languages in Europe, a classical scholar, a philosopher, a learned divine, and an elegant Latin poet. He wrote several books, the principal of which are, his Life of St Thomas of Canterbury, a collection of Letters, and Polycraticon.

Pope JOHN *XII.* a native of Cahore, originally called James d'Euse, was well skilled in the civil and canon law, and was elected pope after the death of Clement V. on the 7th of August 1316. He published the constitutions called *Clementine*, which were framed by his predecessor; and drew up the other constitutions called *Extravagantes.* When Louis of Bavaria was a candidate for the imperial crown, John XII. opposed him in favour of his competitor; which made much noise, and was attended with fatal consequences. That prince, in 1320, caused the antipope Peter de Corbiero, a Cordelier, to be elected, who took the name of Nicolas V. and was supported by Michael de Cesenne, general of his order; but that antipope was the following year taken and carried to Avignon, where he begged pardon of the pope with a rope about his neck, and died in prison some years afterwards. Under this pope arose the celebrated question among the Cordeliers, called "the bread of the Cordeliers;" which was, whether those monks had the property of the things given them, at the time they were making use of them; that is, whether the bread belonged to them when they were eating it, or to the pope, or to the Roman church. This frivolous dispute gave great employment to the pope, as also did those which turned upon the colour, form, and stuff, of their habits, whether they ought to be white, gray, or black; whether the cowl ought to be pointed or round, large or small; whether their robes should be full, short, or long; of cloth, or of serge. The disputes on these minute trifles were carried so far between the minor brothers, that some of them were burned upon the occasion. Pope John died at Avignon in 1334, aged ninety.

John of Fordun. See Fordun.

John of Gaunt, duke of Lancaster, a renowned general, father of Henry IV. king of England, died in 1438.

John Sobieski of Poland, one of the greatest warriors in the seventeenth century, was, in 1665, made grand-marshal of the crown, and, in 1667, grand-general of the kingdom. The victories he obtained over the Tartars and the Turks procured him the crown, to which he was elected in 1674. He was an encourager of arts and sciences, and the protector of learned men. He died in 1696, at the age of seventy-two.

St John's Day, the name of two Christian festivals; one observed on the 24th of June, in commemoration of the wonderful circumstances attending the birth of St John the Baptist; and the other on the 27th of December, in honour of St John the Evangelist.

JOHN'S Island, an island on the southern coast of Carolina, a little to the south-west of Charleston harbour. It is thirty miles in circumference, and is divided from James' Island by Stono River, which forms a convenient and safe harbour. Long. 80. 10. W. Lat. 32. 42. N.

John's, *St*, the capital of the island of Newfoundland. See Newfoundland.

John's, *St*, or *Prince Edward Island*, a fine island, situated in the Gulf of St Lawrence, within the longitudes of 62° and 65° W., and the latitudes of 46° and 47° 10′ N. It is 140 miles in length, and its greatest breadth is thirty-four miles. From Nova Scotia it is separated by Northumberland Strait, which is nine miles broad between Cape Traverse and Cape Tormentine. Cape Breton lies within twenty-seven miles of the east point; and Cape Ray, the nearest part of Newfoundland, is one hundred and twenty miles distant.

This island was discovered by Cabot on the 24th of June 1497, being St John's day, and hence derived its name. The English, however, neglected to avail themselves of this right of possession; and the French, who appear at first to have entertained more correct views of its importance, took possession of it, when they made the conquest of Canada, apparently without any remonstrance on the part of Britain. For a period of two hundred and thirty-five years it continued attached to the crown of France; and although it cannot be said to have advanced in prosperity with an average degree of celerity, considering the value at which such a possession ought to have been rated, yet the resources of the island had not been overlooked, and would probably have been called into activity, had it not been surrendered to Great Britain in 1758. At that time the population in the various settlements appears not to have amounted to more than 6000. At the peace of 1763, this colony and Cape Breton were annexed to the government of Nova Scotia; and a plan of settlement was agreed to, by which the island was divided into sixty-seven townships, of about 20,000 acres each, granted to individuals who were considered as having claims on the government, and who were to pay a small sum as quit-rent. A reservation was set apart for his majesty, and also for the purposes of religion and education; and the grantees were bound to settle each township within a stipulated period, by a given number of individuals. The plan, however, was unsuccessful, and many of the proprietors disposed of their lands to others who had either not the will or not the power to proceed with the colonization of the island, according to the principle originally fixed upon. In 1768, St John's was erected into a separate government from that of Nova Scotia, at the request of a majority of the proprietors; and a governor was appointed, who set vigorously about settling the island in a proper manner, and who did more in this respect than any other proprietor at that time. The colony obtained a complete constitution in 1773, when the first house of assembly met. During the American war, it continued true to the interests of the mother country, and was resorted to by ships of war, as well as converted into a military station. About the year 1790, two provincial corps were raised for the protection of the island, and three troops of volunteer cavalry were likewise formed. As a mark of respect for the Duke of Kent, commander of the British army in America in 1799, the island was then named Prince Edward Island; a very uncalled-for change from St John's, its most appropriate designation. Since that period no event has occurred of such moment as to require particular mention here.

This island, without being mountainous, or possessed of romantic scenery, is agreeably diversified by hill and dale; but the level is, in general, never so far deviated from as to interfere with the purposes of agriculture. There are no mountains, properly so called; but a chain of hills intersects the island breadthwise, about its middle. It abounds with streams, and springs of the purest water; and numerous arms of the sea penetrate so far inland that no part of the country is more than eight miles removed from the flux and reflux of the tide. When first seen, it presents the aspect of a flat country, covered with trees to the margin of the ocean; but, on a nearer approach, the more inviting prospect discloses itself, of villages and farms situated in valleys or on green and gentle declivities, with the other smiling features which result from agricultural industry or spontaneous fertility. Almost every part presents beautiful landscape views, especially in summer and autumn, when the forests exhibit an exuberance of rich and splendid foliage. Unlike Cape Breton, Newfoundland, and other contiguous islands, St John's is very rarely visited by fogs; and although the winter be equally severe, the transitions from one extreme to another are less violent. The season of cold is likewise less protracted than it is in Lower Canada, whilst the frost is not so intense, nor the snows so deep. Altogether the climate is very salubrious, and there are few countries where health is enjoyed with less interruption.

The soil consists of a thin layer of black or brown mould, composed of decayed vegetables, superimposed upon a light loam, occasionally of a sandy, and at other times of a clayey character. This extends about one foot downwards, and then a stiff clay, resting upon sand-stone, predominates. The latter rock is the base of the island, and it appears to extend under the bed of Northumberland Strait, into the contiguous islands, and also into the continent. A solitary block of granite occasionally presents itself; but neither limestone, gypsum, nor coal, have been discovered, although their presence was to have been expected from the occurrence of the sandstone formation. Iron has not yet been found, although the soil and the springs are impregnated with it. Red clay, of a superior quality, for bricks, abounds in all parts; and white clay, for potters' use, is found in limited quantities. The soil is fertile, and its quality can be readily ascertained by the nature of the wood which grows upon it; the richest being that where the maple, beech, black birch, and a mixture of other trees, grow; and the less fertile being that where the varieties of the fir tribe are most abundant. There are some unproductive bogs, swamps, and other tracts called barrens; but they bear but a small proportion to the whole surface of the island, and may, by judicious management, be brought under cultivation. The marshes, which are overflowed by the tide, rear a strong, nutritious grass, and, when dyked, yield heavy crops of wheat or hay. Those swamps also which have been drained form excellent meadows. A very considerable proportion of the island must have formerly been covered with pine forests, and some tracts, from which these have disappeared, partake of the character of barrens. Many of these plantations of wood have been destroyed by fires, which have at different periods raged over the island; and in these places white birches, spruce-firs, poplars, and wild cherry-trees, have sprung up. The poplars grow to an immense size, and are very plentiful. There are many other kinds of trees besides, such as beech, maple, dog-wood, alder, Indian pear tree; and most of the shrubs, wild fruits, herbs, and grasses, common to other parts of British North America. Sarsaparilla, ginseng, and probably many other medicinal plants, are plentiful in all parts of the island. Amongst the wild fruits, rasp-berries, straw-berries, cran-berries, which are very large, blue-berries, and whortle-berries, are exceedingly abundant.

Amongst the quadrupeds native to the island may be mentioned bears, once very numerous and destructive, but now much reduced; loup-cerviers, a deadly enemy of sheep; foxes and hares, which are both numerous; otters, martens, and musk-rats, now rarely met with, from having been long hunted for their skins; varieties of the squirrel in great abundance; and a few weasels and ermines. During spring, summer, and autumn, seals frequent the shores; and walrusses were at one time annual visitants, but they have now entirely disappeared. Partridges and wild pigeons are plentiful, and, as well as hares, are free for any person to kill, no game-laws existing. In spring and autumn, wild geese, ducks, and other water-fowl, are abundant. The reptiles and insects do not require particular notice. The rivers abound with excellent fish, such as trout, eel, mackerel, flounders, oysters, lobsters, the two latter being very large and very fine; and the coast with cod-fish and herrings in great abundance.

Prince Edward Island is essentially an agricultural colony, for which its climate, soil, and the configuration of its surface, admirably adapt it. All kinds of grain and vegetables raised in England arrive at perfection. Crop after crop of wheat springs up without manuring; the barley is excellent, and the oats much superior to any other of American growth. The potatoes and turnips cannot be anywhere excelled in quality, and peas and beans are equally good. Cabbage, carrots, parsnips, and, indeed, all culinary vegetables, thrive as well here as in English gardens. Various fruits are also cultivated, such as cherries, plums, damsons, and the like. Flax, of excellent quality, is raised and wrought into fabrics by private individuals. Hemp grows, but not to such perfection as in other places. The climate is particularly favourable to sheep, and they are exempt from those diseases common to the animal in this country. Black cattle are good, but small; swine thrive well, as also do horses and milk-cows. The breed of useful animals generally has been much improved of late years; and agriculture, by the fostering care of the governor, has recently made decided advances. Such being the natural resources and advantages of this colony, it appears to be admirably adapted for industrious emigrants with small capitals. Before adverting to the trade of the island, it will be necessary to speak of the principal settlements, and its division into three counties, viz. Queen's, King's, and Prince's Counties. These are again divided into parishes, the whole being subdivided into sixty-seven townships, containing about 20,000 acres each. The ground for a town, containing about 400 building lots, with the same number of pasture lots, are reserved in each county. These are, George Town in King's County, Charlotte Town in Queen's County, and Prince Town in Prince's County.

Queen's County contains five parishes, namely, Grenville, Charlotte, Bedford, Hillsborough, and St John's, and comprehends an area of 486,400 acres in the centre of the island. The north coast of this county possesses few harbours, except for smaller vessels; but it is extremely picturesque. On the south shore is Hillsborough Bay, at the bottom of which, and at the confluence of the three rivers Hillsborough, York, and Elliott, Charlotte Town, the capital of the island, and the seat of government, is situated. Its harbour is considered as one of the best and most secure in the Gulf of St Lawrence, though not more than half a mile wide at the entrance. Within this point it widens into a spacious basin, and then branches into three beautiful and navigable rivers. The harbour is protected by several batteries, and it could easily be put into such a state of defence as to secure the town from any attack from the seaward. The town is advantageously situated on ground which rises gradually to a moderate height above the level of the sea. It is regularly laid out, the streets being broad, and intersecting each other at right angles, five or six vacancies being left for squares. There are about three hundred and fifty dwelling-houses, many of them handsomely finished. The public buildings are, the court-house, in which the court of chancery, as well as the court of judicature, are held, and in which the legislative assembly likewise sit; the Episcopal church, the new Scotch church, and the Catholic and the Methodist chapels. The barracks are pleasantly situated near the water, and a neat parade or square occupies the space between those of the officers and privates. On the west side of the harbour lies the Fort or Warren Farm, the most beautiful situation on the island. No place could have been more judiciously selected as a site for the metropolis, than that which has been chosen for Charlotte Town. It is situated almost in the centre of the county, and of easy access, either by water, or by the different roads leading to it from the various other settlements. Indeed there is a maritime communication with a considerable portion of the island by means of the three rivers near the confluence of which it stands. The population amounts to about 3400. Twenty miles west of Charlotte Town, and nearly opposite to *Bai de Verts*, or Green Bay, in Nova Scotia, stands Tryon village, one of the most populous and pleasant places in the island. A serpentine river winds through it, on the banks of which are well-cultivated farms. The tide flows up about two miles; but, from a dangerous bar at its mouth, the harbour will only admit small vessels. On the north coast of this county is New London, in the district of Grenville Bay. The harbour of New London, though safe and convenient, will not admit vessels drawing more than twelve feet of water. The bar is sheltered during north-westerly winds by Cape Tryon, three miles to the north. The lands on the west side of this harbour have long been cultivated; and there was formerly an extensive fishing establishment erected here, but circumstances occurred to interrupt its prosperity. Harrington, or Grand Rustico Bay, has two entrances, and a harbour for small brigs and schooners. Here are two villages inhabited by Acadian French. The surrounding parts of the bay have been populously settled, chiefly by emigrants from Scotland. To the east of Grand Rustico, are Brackly, and Little Rustico, or Stanhope Cove, esteemed two of the finest settlements on the island. Still further east is Bedford, or Tracady Bay, at which there is a small harbour for schooners and small brigs. On the opposite side of the island is Belfast district, which includes the villages of Great and Little Belfast, Orwell, and Point Prince, together with various settlements. The soil here is excellent, and heavy crops are raised, the surplus of which is exported.

King's County, on the east side of the island, is divided into four parishes, viz. East, St Patrick, St George's, and St Andrew's, the whole comprising 412,000 acres. The first, as its name signifies, occupies the whole eastern point of the island, and is destitute of a harbour on its north shore, which is called the District of the Capes. The inhabitants are principally from the west of Scotland and the Hebrides, and they have chiefly applied themselves to agriculture. Owing to the abundant supplies of sea-weed which they possess, they manure the land well, and raise valuable crops, particularly of barley and wheat. Colville, Rollo, Fortune, and Broughton Bays, are small harbours with thriving settlements. St Patrick's parish has a good bay for small vessels on the north shore, called St Peter's, about nine miles long. The settlements on each side are in a flourishing and rapidly improving condition. St Andrew's parish has Murray Harbour and river in it. The former is well sheltered, but of difficult access. Ship-building is carried on here to some extent, and the surrounding country is rapidly improving. George Town, or Three Rivers, is situated in the parish of St George's, on the south-east part of the island. It possesses an excellent and safe harbour, at the junction of three fine rivers, and is well calculated for being the centre of any trade carried on within the Gulf of St Lawrence. Excellent fishing-grounds lie in its vicinity; and at certain seasons of the year herrings enter it in large shoals. The contiguous settlements are rapidly improving, the settlers turning their attention more to agriculture than formerly. Ship-building is carried on here, and a considerable quantity of timber has been exported within the last five-and-twenty years.

Prince's County contains five parishes, namely, North, Egmont, Halifax, Richmond, and St David's, and comprises an area of 467,000 acres. This county possesses several very fine harbours, particularly on the north side, that of Richmond Bay being the largest. This bay is ten miles in depth and nine miles in breadth; and although the centre part is unsheltered, there are several inlets perfectly safe from all winds, with from three to four fathoms of good anchorage.

Six beautiful islands lie within or across the bay, three of which have an area of 500 acres of good land. Lennox Island is the principal rendezvous of the Micmac Indians, once a powerful people, but, like the other aboriginal tribes of the west, now reduced to a mere handful by the arts and the arms of their white subjugators. They profess the Roman Catholic faith, and have here a burying-ground and chapel, where they assemble for a few weeks in summer. A number of townships abut on Richmond Bay, which has a highly advantageous water communication along the coast. It is well situated for cod and herring fisheries, and has afforded several cargoes of timber, as well as vessels built upon the spot, for the English market. The settlers here are principally Scotch, and are, generally speaking, a moral and orderly class of people. To the west of Richmond Bay is Holland Harbour, or Cascumpec, a safe and convenient place of anchorage. The lands around it are well adapted for agriculture; and this place also, by its advantageous situation, is well calculated for extensive fishing establishments. It is the most convenient port in the island for loading timber, where there is a very large quantity; it has also a saw-mill for cutting plank or board.

The population consists of Acadian French and some English families. From Holland Bay to the north-west point (in 47° 7′ north latitude) of the island, a distance of twenty-four miles, the coast is low and sandy, as is likewise the case from North Cape, down towards the West Cape, on the south coast, which forms the western entrance of Egmont Bay. This bay is sixteen miles broad, from the west point to Cape Egmont, and about ten deep. There is no harbour for large vessels within it, and it is by no means very inviting for strange vessels. The inhabitants in this part are chiefly Acadian French, who live in three small thriving villages on the east side of the bay. Farther to the east lies Halifax, or Bedeque Bay, which has a well-sheltered harbour. The shores are populously settled, and there are two or three ship-building establishments here.

When this island was in possession of the French, little commerce was carried on by the inhabitants; but when it came into the hands of the British, a small trade commenced in the articles of fish, oil, sea-cow skins, and seal-skins, which were exported to various parts of the North American continent. Since that period the trade has very materially increased. The following tables show the present state of the commercial and shipping interests of the island.

Vessels which have cleared Inwards and Outwards during the Years 1833 *and* 1834.

	Year ended 5th January 1833.						Year ended 5th January 1834.					
	Inwards.			Outwards.			Inwards.			Outwards.		
	No.	Tons.	Men.	No.	Tons.	Men.	No.	Tons.	Men.	No.	Tons.	Men.
United Kingdom	19	3880	171	20	3793	178	16	3251	151	19	3360	159
British West Indies, including Demerara, Berbice, and Bermuda	2	78	7	6	415	29	1	35	4	2	178	11
British North America, including Newfoundland	251	10522	653	287	14224	770	344	14214	850	368	18069	1065
United States, British vessels / Foreign ditto	2	169	12	2	130	7	1	138	8	...	...	...
St Pierre's	3	133	6	3	118	6	1	61	3	1	61	3
Total	277	14782	849	318	18680	990	363	17699	1016	390	21668	1238

There is also a respectable trade in ship-building carried on in the colony. During the year 1833 there were thirty-two vessels launched and registered, having in the aggregate a tonnage of 4006. The number of vessels

John's, St. employed in the foreign and coasting trade belonging to the island in the same year was, foreign, five vessels, of 1169 tons burden, carrying forty-five men; coasting, 124 vessels, of 6346 tons burden, carrying 359 men. During the year ending December 1832, there were transferred from the island to other ports, thirty-two vessels, of 3202 tons burden in the aggregate. As the best fishing banks within the Gulf of St Lawrence are situated in the neighbourhood of this island, it is surprising that fisheries have not been more attended to. The herring fishery is the most important; immense shoals of these fish arrive on the coast early in spring, and can be taken in any quantity. Cod, mackerel, and other fish, may likewise be caught in abundance. In short, were more attention paid to the fisheries, they would add much to the value of property on the island. Agriculture, however, is not neglected, as will be seen by the following table, showing the quantity of

Goods exported in the Year ending 5th January 1833.

Articles Exported.	Great Britain.	British West Indies.	British North American Colonies.	Total Sterling.
	L.	L.	L.	L.
Oats, 65,747$\frac{1}{2}$ bushels	236	360	3,586	4,185
Barley, 15,262 ditto	117	...	1,612	1,849
Wheat, 9585$\frac{1}{2}$ ditto	2,367	...	199	2,566
Flour, 643$\frac{1}{2}$ barrels	...	...	819	819
Oatmeal, 547 do. 1 pun	42	4	807	854
Beef, 57 ditto	...	...	137	137
Pork, 290 ditto, and 13 pun	...	...	621	621
Dry fish, 1058 quintals	...	10	523	534
Pickled fish, 302$\frac{1}{2}$ barrels	...	...	255	255
Timber, 4601$\frac{1}{4}$ tons	3500	...	142	3,643
Lathwood, 170 cords	161	...	...	161
Spars, 375 do.	47	...	85	133
Staves, 36$\frac{3}{4}$ M.	77	57	28	163
Boards and planks, 1,305,767 feet	170	263	2,316	2,749
Shingles, 1445 M.	...	49	351	400
Cattle, 547 head	...	...	931	931
Sheep, 813 do.	...	...	346	346
Hogs, 63 do.	...	...	33	33
Turnips, 2150 bushels	...	...	107	107
Potatoes, 82,720$\frac{1}{2}$ ditto	...	...	4,100	4,100
Sundries	295	94	6,466	7,144
Total	7,012	840	23,472	31,739

The total amount of imports during the same year was L.70,068. The items were severally thus in the return:—

Brandy	L.443
Cordage	2,189
Dry goods, consisting of bales, cases, casks, trunks, boxes, and bundles	19,423
Nails	1,248
Molasses	1,517
Sail-cloth	1,123
Salt	734
Stationery	181
Soap	659
Sugar	2,164
Rum	8,355
Tea	4,894
Tobacco	1,369
Wine	966
Iron	685
Sundries	24,109

The returns for 1834 show a decided increase in trade, especially that which is dependent upon the cultivation of the soil. But of course the commerce of the island is as yet in its infancy. The following is a statistical view of the island, according to a return made under the authority of the act Will. IV. cap. 7, A. D. 1834, viz.

Townships	67
Acres of land occupied	382,301$\frac{3}{4}$
Acres of improved land ditto	89,757$\frac{1}{2}$
Cows owned	13,185
Oxen ditto	3,267
Other kinds of neat cattle	12,624
Horses	5,866
Sheep	48,076
Hogs	19,864
Bushels of wheat	121,032$\frac{1}{2}$
barley	37,300$\frac{1}{2}$
oats	246,049
potatoes	1,208,766
Grist mills	44
Saw mills	29

The total annual product of property has been estimated at the sum of L.1,146,336; the total moveable property at L.2,056,342; and the total immoveable property at L.1,305,000.

The constitution of this island, like that of the other islands in this quarter, is similar to the government of Britain, and in all civil matters is independent of any jurisdiction in America. The king is represented by a lieutenant-governor, who is also chancellor of the court of chancery. There is a council, consisting generally of twelve members elected by the king's mandamus, and which acts in an executive as well as legislative capacity; and a house of assembly of eighteen members elected by the people, and who manage their affairs after the manner of the British House of Commons. The chief-justice and attorney-general are appointed by the king, and the local government annually nominate the high sheriff. All criminal and civil matters of importance are tried in the supreme court of judicature, by a jury of twelve men. Magistrates and justices of peace take cognizance of smaller matters. The laws by which justice and good government are dispensed and secured are the same as those of England.

In financial matters the island is thus situated. When the soil was originally granted by government to various proprietors, the conditions of the settlement were, that a certain sum should be paid as quit-rent, amounting on an average to about four shillings and sixpence for each hundred acres. But this sum not being regularly paid, government agreed to accept of a composition; and this arrangement, by freeing the land from heavy claims, imparted a new stimulus to the island. In 1833 it was agreed upon by the house of assembly to address his majesty, offering to provide the whole civil expenses of the island, and asking in return that the crown would resign its claim to the quit-rents, and accept of a substitute of 4s. 6d. for every hundred acres in a township. At the same time it was stipulated that a civil list should be granted to the crown, so as to render the governor, judge, and other functionaries, independent of the annual votes of the house. The fate of this proposal is as yet undecided. St John's is one of those colonial islands which, from their native resources not having been sufficiently called forth, is at present of equivocal value to the mother country, in as far as revenue is concerned. The revenue has not always kept pace with the expenditure, as in 1833, when the former amounted to L.7684, and the latter to L.13,759; yet the deficit is to be accounted for by additional outlays for erecting public edifices, and for other useful or necessary purposes. Besides, there was a considerable balance, the remainder of former years; and an issue of treasury notes was made to meet the exigency, a redemption of these being anticipated from the new act levying an assessment upon land. Various causes have contributed to occasion a reduction in the amount of impost duty, such as the failure of crops, and the advanced prices of foreign articles; but such interruptions to prosperity are not likely to remain permanent. With respect to the monetary system, the weights and measures are the same as in England. The dollar is estimated at four shillings and sixpence, and thus becomes five shillings currency; the guinea is L.1. 3s. 4d.; and the other coins are in proportion. The paper currency at present in circulation is supposed to be about L.20,000. There is no banking establishment in the island, which is a material drawback to its prosperity.

The established religion of the colony is the Episcopalian, but the members of the church of Scotland and of that of Rome are supposed to be the most numerous. There are several missionary establishments, and the inhabitants generally are very much awake to the interests of religion, as is shown by the efforts which they have made for its dissemination, as well as that of its powerful auxiliary, education. There is at Charlotte Town a very respectable grammar-school, another on the Madras system, and there are others in most of the settlements for elementary instruction, government devoting a sum for their support. In all, there are seventy-four schools, attended by 2276 scholars. There are two well-conducted newspapers, one of which is published in Charlotte Town, where there is also a public subscription-library on a respectable footing.

We have no data by which to form a correct estimate of the progressive increase of the population. When taken from the French, the island, as we have seen, was supposed to contain about 6000 Acadians. By the census of 1833, the males were in number 15,129, and the females 13,795, making a total population of 28,925; which is an increase since 1827 of 8274. Natives of Scotland constitute more than one half of the whole population; those from the Hebrides are best suited to the island. The Acadian French are estimated at about 5000; but of the Micmac or native Indians, once so numerous, there remain probably not more than thirty families on the island.

JOHN'S, St, one of the Virgin Islands in the West Indies, belonging to Denmark. It is five miles in length by one in breadth, and is situated about thirty-six miles to the east of Porto Rico, and six miles south of the island of St Thomas. It is well watered, and possesses an excellent harbour; but the land in general is of little value, and the exports are trifling. It contains a population of 2430, of whom only 180 are whites. Long. 64. 32. W. Lat. 18. 7. N.

JOHNSON, or Jonson, Ben, one of the most distinguished dramatic poets of the Elizabethan age, whether we consider the number or the merit of his productions. He was born at Westminster in 1574, and was educated at the public school there, under the great Camden. He was descended from a Scottish family; but as his father, who had lost his estate under Queen Mary, died before our poet was born, and his mother married a brick-layer for her second husband, Ben was taken from school to work at his father-in-law's trade. Not being captivated with this employment, however, he went into the Low Countries, and distinguished himself in a military capacity. On his return to England, he entered himself at St John's College, Cambridge; and having killed a person in a duel, he was condemned, and narrowly escaped execution. After this he turned actor; and Shakspeare is said to have first introduced him to the world, by recommending a play of his to the stage, after it had been rejected. His Alchymist gained him such reputation, that in 1619 he was, at the death of Mr Daniel, made poet-laureate to King James I. and master of arts at Oxford. As we do not find Jonson's economical virtues anywhere recorded, it is the less to be wondered that, after this, we should find him petitioning King Charles, on his accession, to enlarge his father's allowance of a hundred merks into pounds; and soon afterwards we learn that, being very poor and sick, he lodged in an obscure alley. On this occasion it was that Charles, having been moved in his favour, sent him ten guineas, upon which Ben remarked, "His majesty sent me ten guineas because I am poor, and live in an alley; go and tell him that his soul lives in an alley." He died in August 1637, at the age of sixty-three, and was buried in Westminster Abbey. The most complete edition of his works was that printed in 1756, in 7 vols. 8vo.

Johnson, *Dr Samuel*, one of the brightest ornaments of the eighteenth century, was born in the city of Litchfield, in Staffordshire, on the 18th of September 1709. His father Michael was a bookseller, and must have had some reputation in the city, as he more than once held the office of chief magistrate. By what casuistry he reconciled his conscience to the oaths required to be taken by all who occupy such stations cannot now be known; but it is certain that he was zealously attached to the exiled family of Stuart, and instilled the same principles into the youthful mind of his son. So earnest was he in this, and at so early a period did he commence it, that when Dr Sacheverel, in his memorable tour through England, came to Litchfield, Mr Johnson carried his son, not then quite three years of age, to the cathedral, and placed him on his shoulders, that he might see as well as hear the famous preacher.

But political prejudices were not the only doubtful qualities which young Sam inherited from his father. He derived from the same source a morbid melancholy, which, though it neither depressed his imagination, nor clouded his perceptions, filled him with dreadful apprehensions of insanity, and rendered him wretched through life. From his nurse he contracted the scrofula or king's evil, which made its appearance at a very early period, disfigured a face naturally well-formed, and deprived him of the sight of one of his eyes.

When he had arrived at a proper age for receiving grammatical instruction, he was placed in the free school of Litchfield, of which Mr Hunter was then master; a man whom his illustrious pupil thought "very severe, and wrongheadedly severe," because he would beat a boy for not answering questions which the latter could not expect to be asked of him. He was, however, a skilful teacher; and Johnson, when he stood in the very front of learning, was sensible how much he owed to him; for upon being asked how he had acquired so accurate a knowledge of the Latin tongue, he replied, "My master beat me very well; without that, Sir, I should have done nothing."

At the age of fifteen, Johnson was removed from Litchfield to the school of Stourbridge in Worcestershire, at which he remained little more than a year, and then returned home, where he staid two years without any settled plan of life or any regular course of study. But he read a great deal in a desultory manner, as chance threw books in his way, and as inclination directed him through them; so that when, in his nineteenth year, he was entered a commoner of Pembroke College, Oxford, his mind was stored with a variety of such knowledge as is not often acquired in universities, where boys seldom read any books but those which are put into their hands by their tutors. He had given very early proofs of his poetical genius, both in his school exercises and in other occasional compositions; but what is perhaps more remarkable, as evincing that he must have thought a good deal on a subject on which other boys of that age seldom think at all, he had, before he was fourteen, entertained doubts of the truth of revelation. From the melancholy of his temper, these naturally preyed upon his spirits, and gave him great uneasiness; but they were happily removed by a proper course of reading; for his studies being honest, ended in conviction. He found that religion was true; and what he had learned by inquiry, he ever afterwards endeavoured to teach to mankind.

Concerning his residence at the university, and the means by which he was there supported, his two principal biographers contradict each other; and hence on these points it is impossible to write with certainty. According to Sir John Hawkins, the time of his continuance at Oxford is divisible into two periods; but Mr Boswell represents it as only one period, with the usual interval of a long vacation. Sir John says that he was supported at college by Mr Andrew Corbet, in quality of assistant to his son. But Mr Boswell assures us, that though he was promised pecuniary aid by Mr Corbet, that promise was not in any degree fulfilled. With regard to the knight's account of this transaction, it seems to be inconsistent with itself. He says, that the two young men were entered in Pembroke on the same day; that Corbet continued in the college two years; but that Johnson was driven home in little more than one year, because, by the removal of Corbet, he was deprived of his pension. A story of which one part contradicts the other cannot be wholly true. Sir John adds, that "meeting with another source, the bounty, as is supposed, of some one or more of the members of the cathedral of Litchfield, he returned to college, and made up the whole of his residence in the university about three years." Mr Boswell has told us nothing more than that Johnson, though his father was unable to support him, continued three years in college, and that he was then driven from it by extreme poverty.

These gentlemen differ likewise in their accounts of Johnson's tutors. Sir John Hawkins says that he had two, Mr Jordan and Dr Adams. Mr Boswell affirms that Dr Adams could not be his tutor, because Jordan did not quit the college till 1731, the year in the autumn of which Johnson himself was compelled to leave Oxford. Yet the same author represents Dr Adams as saying, "I was Johnson's nominal tutor, but he was above my mark;" a speech of which it is not easy to discover the meaning, if it formed no part of Johnson's duty to attend upon Adams's prelections. In most colleges we believe there are two tutors in different departments of education; and therefore it is not improbable that Jordan and Adams may have been at the same time tutors to Johnson, the one in languages, and the other in science. Jordan was a man of such mean abilities, that though his pupil loved him for the goodness of his heart, he would often risk the payment of a small fine rather than attend his prelections; nor was he studious to conceal the reason of his absence. Upon occasion of one such imposition, Johnson is reported to have said, "Sir, you have sconced me twopence for non-attendance at a lecture not worth a penny." For some transgression or absence his tutor imposed upon him, as a Christmas exercise, the task of translating into Latin verse Pope's *Messiah*. This Johnson performed, and on his translation being shown to the author of the original, the latter, after perusal, returned it with this observation, "The writer of this poem will leave it a question for posterity, whether his or mine be the original." The particular course of his reading whilst in college, and during the vacation which he passed at home, cannot be traced. That at this period he read much, we have his own evidence in what he afterwards told the king; but his mode of study was never regular, and at all times he thought more than he read. He informed Mr Boswell, that what he read solidly at Oxford was Greek, and that the study of which he was fondest was that of metaphysics.

In the year 1731 Johnson left the university without a degree; and as his father, who died in the month of December of that year, had suffered great misfortunes in trade, he was driven out as a commoner of nature, and excluded from the regular modes of profit and prosperity. Having therefore not only a profession, but the means of subsistence, to seek, he, in the month of March 1732, accepted an invitation to the office of under-master of a free school at Market-Bosworth, in Leicestershire; but not knowing, as he said, whether it was more disagreeable for him to teach or for the boys to learn the rules of grammar, and being likewise disgusted at the treatment which he had received from the patron of the school, he in a few months relinquished a situation which he ever afterwards recollected with horror. Being thus again without any fixed employment, and with very little money in his pocket, he translated Lobo's Voyage to Abyssinia, for the trifling sum, it is said, of five guineas, which he received from a bookseller in Birmingham. This was the first attempt which he made to procure pecuniary assistance by means of his pen; and it must have held forth very little encouragement to his commencing author by profession.

In 1735, being then in his twenty-sixth year, he married Mrs Porter, the widow of a mercer in Birmingham; a woman whose age was almost double his, whose external form had never been captivating, and whose fortune amounted to scarcely L.800. That she had a superiority of understanding and talents, is extremely probable, both because she certainly inspired him with a more than ordinary passion, and because she was herself so delighted with the charms of his conversation as to overlook his external disadvantages, which were many and great. He now set up a private academy, for which purpose he had hired a large house, well situated, near his native city; but his name having then nothing of that celebrity which afterwards commanded the attention and respect of the world, this undertaking did not succeed. The only pupils who are known to have been placed under his care, were the celebrated David Garrick, his brother George Garrick, and a young gentleman of fortune, of the name of Offely. He kept this academy only a year and a half; and it was during the period in question that he constructed the plan and wrote the greater part of his tragedy of *Irene*.

The respectable character of his parents, and his own merit, had secured him a kind reception in the best families at Litchfield; and he was particularly distinguished by Mr Walmsley, registrar of the ecclesiastical court, a man of great worth, and of extensive and various erudition. That gentleman, upon hearing part of Irene read, thought so highly of Johnson's abilities as a dramatic writer, that he advised him by all means to complete the tragedy and produce it on the stage. To men of genius the stage holds forth temptations almost irresistible. The profits arising from a tragedy, including the representation and printing of it, and the connections which it sometimes enables the author to form, were in Johnson's imagination inestimable. Flattered, it may be supposed, with these hopes, he, in the year 1737, set out for London, with his pupil David Garrick, leaving Mrs Johnson to take care of the house and the wreck of her fortune. The two adventurers carried with them from Mr Walmsley an earnest recommendation to the Reverend Mr Colson, then master of an academy, and afterwards Lucasian professor of mathematics in the university of Cambridge; but from that gentleman it does not appear that Johnson ever found either protection or encouragement.

How he spent his time upon his arrival in London is not particularly known. His tragedy was refused by the managers of the day; and for some years the Gentleman's Magazine seems to have been his principal resource for employment and support. To enumerate his various communications to that miscellany would be equally tedious and unnecessary. It is sufficient to say, that his connection with Cave the proprietor became very close; that he wrote prefaces, essays, reviews of books, and poems; and that he was occasionally employed in correcting the papers written by other correspondents. When the complaints of the nation against the administration of Sir Robert Walpole became loud, and on the 13th of February 1740 a motion was made to remove him from his majesty's counsels for ever, Johnson was pitched upon by Cave to write what was in the Magazine entitled "Debates in the Senate of Lilliput," but was understood to be the speeches of the most eminent members in both houses of parliament. These orations, which induced Voltaire to compare British with ancient eloquence, were hastily sketched by Johnson whilst he was not yet thirty-two years of age, but little acquainted with life, and struggling, not for distinction, but for existence. Perhaps in none of his writings has he given a more conspicuous proof of a mind prompt and vigorous almost beyond conception. They were composed from scanty notes taken by illiterate persons employed to attend in both houses; and sometimes he had nothing communicated to him but the names of the several speakers, and the part which they took in the debate.

His separate publications which at this time attracted the greatest notice were, *London*, a poem in imitation of Juvenal's third Satire; *Marmor Norfolciense*, or an Essay on an ancient prophetical Inscription in Monkish Rhyme, discovered near Lynne, in Norfolk; and a complete Vindication of the Licensers of the Stage from the malicious and scandalous aspersions of Mr Brook, author of Gustavus Vasa. The poem, which was published in 1738, by Dodsley, is universally known and admired as the most spirited instance in the English language of ancient sentiments adapted to modern topics. Pope, who then filled the poetical throne without a rival, being informed that the author's name was Johnson, and that he was an obscure person, replied, "He will soon be *deterré*." The two pamphlets, which were published in 1739, are filled with keen satire on the government. Sir John Hawkins has thought fit to declare that they display neither learning nor wit; but Pope was of a different opinion; for in a note of his preserved by Mr Boswell, he says, that "the whole of the Norfolk prophecy is very humorous."

Mrs Johnson, who went to London soon after her husband, now lived sometimes in one place and sometimes in another, sometimes in the city and sometimes at Greenwich; but Johnson himself was oftener to be found at St John's Gate, where the Gentleman's Magazine was published, than in his own lodgings. It was there that he became acquainted with Savage, with whom he was induced, probably by the similarity of their circumstances, to contract a very close friendship; and such were their extreme necessities, that they often wandered during whole nights in the street, for want of money to procure them a lodging. In one of these nocturnal rambles, when their distress was almost incredible, so far were they from being depressed by their situation, that, in high spirits and brimful of patriotism, they traversed St James's Square for several hours, inveighed against the minister, and, as Johnson said in ridicule of himself, his companion, and all such pennyless patriots, "resolved that *they* would stand by their country." In 1744, he published the life of his unfortunate companion; a work which, had he never written any thing else, would have placed him very high in the rank of authors. His narrative is remarkably smooth and well disposed; his observations are just, and his reflections disclose the inmost recesses of the human heart. But, to say nothing of the pretended birth of Savage, whom Mr Boswell considered as an impostor, the moral character of this person was undoubtedly unworthy of such a biographer; and it is not easy to discover any thing either in his intellectual or poetical qualifications which could reasonably have entitled him to the prominent place amongst English poets which the partiality of Johnson has assigned to his companion in misfortune.

In 1749, when Drury-lane theatre was opened under the management of Garrick, Johnson wrote for the occasion a prologue, which, for just dramatic criticism, as well as poetical excellence, is confessedly unrivalled. This year is also distinguished in his life as the epoch when his arduous and important work, the *Dictionary of the English Language*, was announced to the world by the publication of its plan or prospectus, addressed to the Earl of Chesterfield. From that nobleman Johnson was certainly led to expect patronage and encouragement; and it seems equally certain that his lordship expected, when the book made its appearance, to be honoured with the dedication. But the expectations of both were disappointed. Lord Chesterfield, after once or twice seeing the lexicographer, suffered him to be repulsed from his door; but afterwards thinking to conciliate him when the work was upon the eve of publication, he wrote two papers in *The World*, warmly recommending it to the public. This artifice was seen through; and Johnson, in very polite language, rejected his lordship's advances, letting him know that he was unwilling the public should consider him as owing that to a patron which Providence had enabled him to do for himself. This great and laborious work its author expected to complete in three years; but he was certainly employed upon it seven years; for we know that it was begun in 1747, and that the last sheet was sent to the press in the end of the year 1754. When we consider the nature of the undertaking, it is indeed astonishing that it was finished so soon, since it was written, as he says, "with little assistance of the learned, and without any patronage of the great; not in the soft obscurities of retirement, or under the shelter of academic bowers, but amidst inconvenience and distraction, in sickness and in sorrow." The sorrow to which he here alludes is probably that which he felt for the loss of his wife, who died in March 1752, and the loss of whom he continued to lament as long as he lived.

The Dictionary did not occupy his whole time; for whilst he was pushing it forward, he fitted his tragedy for the stage, wrote the lives of several eminent men for the Gentleman's Magazine, published an Imitation of the tenth Satire of Juvenal, entitled the Vanity of human Wishes, and began and finished *The Rambler*. This last work is so well known, that it is hardly necessary to say that it was a periodical paper, published twice a week, from the 20th of March 1750 to the 14th of March 1752 inclusive; but to convey some notion of the vigour and promptitude of the author's mind, it may not be improper to observe, that notwithstanding the severity of his other labours, all the assistance which he received did not amount to five papers; and that many of the most masterly of these essays were written on the spur of the occasion, and were never seen entire by the author till they returned to him from the press.

Soon after the Rambler was concluded, Dr Hawkesworth projected *The Adventurer*, upon a similar plan; and, by the assistance of friends, he was enabled to carry it on with almost equal merit. For a short time, indeed, it was the more popular work of the two; and the papers with the signature T, which are confessedly the most splendid in the whole collection, are now known to have been communicated by Johnson, who received for each the sum of two guineas. This was double the price for which he sold sermons to such clergymen as either would not or could not compose their own discourses; indeed he seems to have made a kind of trade of sermon-writing.

Though, during the time that he was employed on the Dictionary, he had exhausted more than the sum for which the booksellers had bargained as the price of the copy, yet, by means of the Rambler, Adventurer, sermons, and other productions of his pen, he now found himself in greater affluence than he had ever before been; and as the powers of his mind, distended by long and severe exercise, required relaxation to restore them to their proper tone, he appears to have done little or nothing from the close of the Adventurer till the year 1756, when he undertook the office of reviewer in the Literary Magazine. Of his reviews, by far the most valuable is that of Soame Jenyns's Free Inquiry into the Nature and Origin of Evil. Never were wit and metaphysical acuteness more closely united than in that criticism, which exposes the weakness and holds up to contempt the reasonings of those vain mortals who presumptuously attempt to grasp the scale of existence, and to form plans of conduct for the Creator of the universe. But the furnishing of magazines, reviews, and even newspapers, with literary intelligence, and authors of books with dedications and prefaces, was considered as an employment unworthy of Johnson. It was therefore proposed by the booksellers that he should give a new edition of the dramas of Shakspeare; a work which he had projected many years before, and of which he had published a specimen which was commended by Warburton. When one of his friends expressed a hope that this employment would furnish him with amusement, and add to his fame, he replied, "I look upon it as I did upon the Dictionary; it is all work; and my inducement to it is not love or desire of fame, but the want of money, which is the only motive to writing that I know of." He issued proposals, however, of considerable length, in which he showed that he knew perfectly what a variety of research such an undertaking required; but his indolence prevented him from pursuing it with diligence, and it was not published till many years afterwards.

On the 15th of April 1785, he began a new periodical paper entitled *The Idler*, which came out every Saturday, in a weekly newspaper called the Universal Chronicle, or Weekly Gazette, published by Newberry. Of these essays, which were continued till the 5th of April 1760, many were written as hastily as an ordinary letter; and one in particular, composed at Oxford, was begun only half an hour before the departure of the post which carried it to London. About this time he had the offer of a living, of which he might have rendered himself capable by entering into orders. It was a rectory, in a pleasant country, of such yearly value as would have been an object to one in much better circumstances; but, sensible, as is supposed, of the asperity of his temper, he declined it, saying, "I have not the requisites for the office, and I cannot in my conscience shear the flock which I am unable to feed."

In the month of January 1759, his mother died, at the advanced age of ninety; an event which deeply affected him, and gave birth to the forty-first paper in the Idler, in which he laments, that "the life which made his own life pleasant was at an end, and that the gate of death was shut upon his prospects." Soon afterwards he wrote his *Rasselas, Prince of Abyssinia*, that with the profits he might defray the expense of his mother's funeral, and pay some debts which she had left. He told a friend that he received for the copy L.100, and L.25 more when it came to a second edition; that he wrote it in the evenings of a week, sent it to the press in portions as it was written, and had never since read it.

Hitherto, notwithstanding his varions publications, he was poor, and obliged to provide by his labour for the wants of the day that was passing over him; but having been, early in 1762, represented to the king as a very learned and good man, without any certain provision, his majesty was pleased to grant him a pension, which Lord Bute, then first minister, assured him, "was not given for any thing which he was to do, but for what he had already done." But a fixed annuity of three hundred pounds, if it diminished his distress, increased his indolence; for as he constantly avowed that he had no other motive in writing than to gain money, as he had now what was abundantly sufficient for all his purposes, and as he delighted in conversation, and was visited and admired by the witty, the elegant, and the learned, very little of his time was passed in solitary study. Solitude was indeed his aversion; and, that he might avoid it as much as possible, Sir Joshua Reynolds and he, in 1764, instituted a club, which existed long without a name, but was afterwards known by the title of the Literary Club. It consisted of some of the most enlightened men of the age, who met at the Turk's Head in Gerard Street, Soho, one evening in every week, at seven, and till a late hour enjoyed "the feast of reason and the flow of soul."

In 1765, when Johnson was more than usually oppressed with constitutional melancholy, he was fortunately introduced into the family of Mr Thrale, one of the most eminent brewers in England, and member of parliament for the borough of Southwark; and it is but justice to acknowledge, that to the assistance which Mr and Mrs Thrale gave him, to the shelter which their house afforded him for sixteen or seventeen years, and to the pains which they took to soothe or repress his uneasy fancies, the public is probably indebted for some of the most masterly as well as the most popular works which he ever produced. At length, in the October of this year, he gave to the world his edition of Shakspeare, which is chiefly valuable for the preface, where the excellencies and defects of that immortal bard are displayed with a judgment which must please every man whose taste is not regulated by the standard of fashion or national prejudice, and where the question of the unities is discussed with an ability and force of reasoning which leaves nothing to be added or desired on the subject. In 1767 he was honoured by a private conversation with the king, in the library at the queen's house; and two years afterwards, upon the establishment of the Royal Academy of Painting and Sculpture, he was nominated professor of ancient literature; an office merely honorary, and conferred on him, as is supposed, at the recommendation of his friend the president.

In the variety of subjects on which he had hitherto exercised his pen, he had forborne, since the administration of Sir Robert Walpole, to meddle with the disputes of contending factions; but having seen with indignation the methods which, in the business of Mr Wilkes, were taken to work upon the populace, he published in 1770 a pamphlet, entitled *The False Alarm,* in which he asserts, and labours to prove by a variety of arguments founded on precedents, that the expulsion of a member of the House of Commons is equivalent to exclusion, and that no such calamity as the subversion of the constitution was to be feared from an act warranted by usage, and conformable to the law of parliament. Whatever may be thought of the principles maintained in this publication, it unquestionably contains much wit and argument, expressed in the author's best style of composition; and yet it is known to have been written between eight o'clock on Wednesday night and twelve o'clock on the Thursday night, when it was read to Mr Thrale upon his return from the House of Commons. In 1771 he published another political pamphlet, entitled *Thoughts on the Late Transactions respecting Falkland's Islands,* in which he attacked *Junius;* and he ever afterwards delighted himself with the thought of having vanquished that able writer, whom he certainly rivalled in nervous language and pointed ridicule.

In 1773, he, in company with Mr Boswell, visited some of the most considerable of the Hebrides or Western Islands of Scotland, and published an account of his journey, in a volume which abounds in extensive philosophical views of society, ingenious sentiments, and lively descriptions, but which offended many persons by the vehement attack which it contained on the authenticity of the poems attributed to Ossian. For the degree of offence that was taken, the book can hardly be thought to contain a sufficient reason; and if the antiquity or genuineness of these poems be yet doubted, this is owing more to the conduct of their editor than to the violence of Johnson. In 1774, the parliament being dissolved, he addressed to the electors of Great Britain a pamphlet, entitled *The Patriot;* of which the design was to guard them from imposition, and teach them to distinguish true from false patriotism. In 1775 he published *Taxation no Tyranny, in Answer to the Resolutions and Address of the American Congress.* In this performance his admirer Mr Boswell cannot, he says, perceive that ability of argument or felicity of expression for which on other occasions Johnson was remarkable. This seems a singular criticism. To the assumed principle upon which the reasoning of the pamphlet rests many have objected, and perhaps their objections are well founded; but if it be admitted that "the supreme power of every community has the right of requiring from all its subjects such contributions as are necessary to the public safety or public prosperity," it will be found a difficult task to break the chain of argument by which it is proved that the British parliament had a right to tax the Americans. As to the style of the pamphlet, the reader who adopts the maxim recorded in the *Journal of a Tour to the Hebrides,* that a controversialist "ought not to strike soft in battle," must acknowledge that it is uncommonly happy, and that the whole performance is one of the most brilliant as well as correct pieces of composition that ever fell from the pen of its author. These essays drew upon him numerous attacks, all of which he heartily despised; for though it has been supposed that a Letter addressed to Dr Samuel Johnson occasioned by his Political Publications, gave him great uneasiness, the contrary is manifest, from his having, after the appearance of that letter, collected them into a volume under the title of *Political Tracts by the Author of the Rambler.* In 1765 Trinity College, Dublin, had created him doctor of laws by diploma; and he now received the same honour from the University of Oxford, an honour with which, though he did not boast of it, he was highly gratified. In 1777 he was induced, by a case of an extraordinary nature, to exercise that humanity which in him was obedient to every call. Dr William Dodd, a clergyman, under sentence of death for the crime of forgery, found means to interest Johnson in his behalf, and procured from him two of the most energetic compositions ever written; the one being a petition from himself to the king, and the other a similar address from his wife to the queen. But these petitions failed of success. Lord Mansfield's opinion was unfavourable to Dodd, and the reverend forger underwent the last punishment of the law.

The principal booksellers in London having determined to publish a body of English poetry, Johnson was prevailed upon to write the lives of the poets, and give a character of the works of each. This task he undertook with alacrity, and upon the whole executed it in a manner worthy of his reputation. The work was published in ten small volumes, of which the first four appeared in 1778, and the others in 1781. Whilst the world in general was filled with admiration of the great powers of the man who at the age of seventy-two, and labouring under a complication of diseases, could produce a work which displays so much genius and learning, there were narrow circles in which prejudice and resentment were fostered, and whence attacks of different sorts issued against him. But these gave him not the smallest disturbance. When told of the feeble though shrill outcry that had been raised, he replied, "Sir, I considered myself as intrusted with a certain portion of truth. I have given my opinion sincerely; let them show where they think me wrong."

He had hardly begun to reap the laurels gained by this performance, when death deprived him of Mr Thrale, in whose house he had enjoyed the most comfortable hours of his life; but it abated not in Johnson that care for the interests of those whom his friend had left behind him, and whom he thought himself bound to cherish, in duty as one of the executors of his will, and in gratitude for the kindness he had experienced at his hands. On this account, his visits to Streatham, Mr Thrale's villa, were for some time after his death regularly made on Monday, and protracted till Saturday, as they had been during his life; but they soon became less frequent, and at length he studiously avoided the mention of the place or the family. Mrs Thrale, who ere long changed her name for that of Mrs Piozzi, says, indeed, that "it grew extremely perplexing and difficult to live in the house with him when the master of it was no more, because his dislikes grew capricious, and he could scarce bear to have any body come to the house whom it was absolutely necessary for her to see." The person whom she thought it most necessary for her to see may perhaps be guessed at without any extraordinary share of sagacity; and if these were the visits which Johnson could not bear, posterity, so far from thinking his dislikes capricious, though they may have been perplexing, would, if he had acted otherwise, have blamed him for the want of gratitude to the friend whose "face for fifteen years had never been turned upon him but with respect or benignity."

About the middle of June 1783, his constitution sustained a severer shock than it had ever before experienced, from a stroke of the palsy, which was so sudden and so violent, that it awakened him out of a sound sleep, and rendered him for a short time speechless. As usual, he had recourse, under this affliction, to piety, which in him was constant, sincere, and fervent. He tried to repeat the Lord's prayer, first in English, then in Latin, and afterwards in Greek; but succeeded only in the last attempt, immediately after which he was again deprived of the power of articulation. From this alarming attack he in a short time recovered, but it left behind it presages of a dropsical affection; and he was soon afterwards seized with a spasmodic asthma of such violence that he was confined to the house in great pain, whilst his dropsy increased, notwithstanding all the efforts of the most eminent physicians. He had, however, such an interval of ease as enabled him, in the summer of 1784, to visit his friends at Oxford, Litchfield, and Ashbourne in Derbyshire. One day the Roman Catholic religion being introduced as the topic of conversation when he was in the house of Dr Adams, Johnson said, "If you join the Papists externally, they will not interrogate you strictly as to your belief in their tenets. No reasoning Papist believes every article of their faith. There is one side on which a good man might be persuaded to embrace it. A good man of a timorous disposition, in great doubt of his acceptance with God, and pretty credulous, might be glad of a church where there are so many helps to go to heaven. I would be a Papist if I could. I have fear enough; but an obstinate rationality prevents me. I should never be a Papist unless on the near approach of death, of which I have very great terror." His constant dread of death was indeed so great, that it astonished all who had access to know the piety of his mind and the virtues of his life. Attempts have been made to account for it in various ways; but that probably is the true account which is given by an elegant and pious writer, in the *Olla Podrida*. "That he should not be conscious of the abilities with which Providence had blessed him was impossible. He felt his own powers; he felt what he was capable of having performed; and he saw how little, comparatively speaking, he had performed. Hence his apprehension on the near prospect of the account to be made, viewed through the medium of constitutional and morbid melancholy, which often excluded from his sight the bright beams of divine mercy." This, however, was the case only whilst death was approaching from a distance. From the time that he was certain it was near, all his fears were calmed; and he died on the 13th of December 1784, full of resignation strengthened by faith, and joyful in hope.

Dr Johnson was a man of herculean form of body, as well as of great powers of mind. His stature was tall, his limbs were large, his strength was more than common, and his activity in early life had been greater than such a form gave reason to expect; but he was subject to an infirmity of the convulsive kind, resembling the distemper called St Vitus's dance; and he had the seeds of so many diseases sown in his constitution, that a short time before his death he declared that he hardly remembered to have passed one day wholly free from pain. He possessed extraordinary powers of understanding, which were much cultivated by reading, and still more by meditation and reflection. His memory was retentive, his imagination vigorous, and his judgment penetrating. He read with great rapidity, retained with wonderful exactness what he so easily collected, and possessed the power of reducing to order and system the scattered hints on any subject which he had gathered from different books. It would not be safe to claim for him the highest place amongst his contemporaries in any single department of literature; but he brought more mind to every subject, and had a greater variety of knowledge ready for all occasions, than any other man that could easily be named. Though prone to superstition, he was in other respects so incredulous, that Hogarth observed, whilst Johnson firmly believed the Bible, he seemed determined to believe nothing but the Bible. Of the importance of religion he had a strong sense; his zeal for its interests was always awake, whilst profaneness of every kind was abashed in his presence. The same energy which he displayed in his literary productions, or even greater, was exhibited also in his conversation, which was various, striking, and instructive. Like the sage in Rasselas, he spoke, and attention watched his lips; he reasoned, and conviction closed his period. When he pleased, he could be the greatest sophist that ever contended in the lists of declamation; and perhaps no man ever equalled him in nervous and pointed repartees. His veracity, from the most trivial to the most solemn occasions, was strict even to severity. He scorned to embellish a story with fictitious circumstances; for what is not a representation of reality, he used to say, is not worthy of our attention. As his purse and his house were ever open to the indigent, so was his heart tender to those who wanted relief, and his soul susceptible of gratitude, and every kind impression. He had a roughness in his manner which subdued the saucy and terrified the meek; but it was only in his manner, for no man was more loved than Johnson by those who knew him; and his works will be read with admiration as long as the language in which they are written shall be understood.

JOHNSTON, Arthur, a very eminent Latin poet, was the fifth son of George Johnston of Caskieben, by Christian the daughter of Lord Forbes.[1] The father, who was possessed of extensive estates, had a numerous family, six sons and seven daughters having reached the age of maturity. Arthur was born at Caskieben in the county of Aberdeen in the year 1587, but the day of his birth is not mentioned. The first elements of classical learning he acquired at the neighbouring town of Kintore, and he afterwards became a student in Marischal College, Aberdeen. Caskieben, Kintore, Inverury, and Aberdeen are all commemorated in his poems. Whether he resided in the university long enough to take a degree in arts, we are not informed; but it is probable that he proceeded to the continent at a very early age, for he took the degree of M. D. at Padua on the 11th of June 1610. This university was long celebrated as a school of physic as well as law; and Benson supposes that it may have afforded him a favourable opportunity for the cultivation of his talents for Latin poetry.

In an elegy addressed to Wedderburn, he has supplied us with some information respecting his personal history.

Quas ego non terras, quæ non vagus æquora pressi,
  Hæc licet ingenio sint minus apta meo?
Bis mihi trajectæ vicinæ nubibus Alpes;
  Tybris et Eridani pota bis unda mihi est.
Præbuit hospitium bis binis Gallia lustris:
  Conjugis hæc titulum terra patrisque dedit.
Me Geta, me Batavus, me vidit Cimber et Anglus,
  Et quæ Teutonico terra sub axe riget.
Non tot Dulichius pater est erroribus actus,
  Dum peteret patrios per vada sæva lares.
Quinta Caledoniæ me rursus Olympias oræ
  Reddidit effætum, dissimilemque mei.
Numina jam decies et ter fecere parentem;
  Pignora sex superant, cætera turba fuit.
Bis mihi quæsivi, nec ab una gente, maritam:
  Bis conjunx, bis jam me reor esse senem.

From these verses we learn that he had twice crossed the

[1] Douglas's Baronage of Scotland, p. 36. Johnston's Genealogical Account of the Family of Johnston of that *ilk*, formerly of Caskieben, p. 7. Edinb. 1832, 4to.

Alps, and had twice visited Rome; that he had travelled in Germany, the Netherlands, Denmark, and England; that he had resided twenty years in France, and had there become a husband and a father; and that two wives, who were of different nations, had born him thirteen children. The fifth Olympiad restored him to his native country. The term *Olympias* more properly denotes a period of four years, but here, as in other instances, it is evidently employed to denote a period of five: for it appears that he had spent twenty years in France, and he mentions his peregrinations in other countries. He must therefore have returned to Scotland before the completion of the twenty-fifth year. Sir Thomas Urquhart has stated that "before he was full three and twenty yeers of age, he was laureated poet at Paris, and that most deservedly."[1] He spent a considerable time in the university of Sedan,[2] where his very learned countryman Andrew Melville became a professor of divinity in the year 1611. With him and the other divinity professor, Daniel Tilenus, he appears to have lived on intimate terms; and the names of both are familiar to the readers of his poems. As he resided so long in France, it has been supposed that he there followed the profession of a physician. The names of his two wives are not mentioned; but one of them is described as a woman of honourable birth. The one he married in France, and the other belonged to the vicinity of Mechlin, a city in Brabant. In an elegy addressed "Ad Senatum Mechliniensem, adversus Hamptæum militem Bulloniensem," he speaks of her in the subsequent terms:

> Quid memorem lachrymas quas nunc, absente marito,
> Fundit in ignota flebilis uxor humo?
> Per patriam rogat illa suam, patriosque penates,
> Quos dirimit vestra quartus ab urbe lapis.

He appears to have left her in Britain, and to have repaired to Mechlin for the purpose of prosecuting against this rude soldier some claim which probably accrued to him by marriage. After many delays and much anxiety, he obtained a decision in his favour; and his feelings during the progress of this litigation are elegantly recorded in various poems.

Before his return to Britain, he had acquired considerable reputation by the exercise of his poetical talents. Dr Eglisham, another Scottish physician, had endeavoured to detract from the reputation of Buchanan, by publishing an acrimonious criticism upon his version of the hundred and fourth psalm; but in one respect he was a very fair critic, for he at the same time exhibited in contrast a version of his own.[3] Instead of attempting a serious refutation of his animadversions, Johnston wrote a very bitter, though a very elegant satire, in which he treated his case as one of decided insanity. This poem was speedily published under the title of "Consilium Collegii Medici Parisiensis de Mania G. Eglishemii, quam prodidit scripto, cui titulus Duellum Poeticum," &c. Edinburgi, excudebat Andreas Hart, 1619, 8vo. A Paris edition of the same date is likewise mentioned. This publication is anonymous; and when he inserted the poem in the collection of his *Parerga*, he suppressed the name of Eglisham, and substituted that of Hypermorus Medicaster. Not satisfied with inflicting so signal a castigation, he assailed the unfortunate rival of Buchanan in another poem, entitled *Onopordus Furens*. Paris. 1620, 8vo. During the same year, Dr Barclay, another learned physician, refuted the captious criticisms of Eglisham, and exposed the puerility of the version to which the author's vanity had assigned so conspicuous a place.

Dr Johnston's next publication bears the title of "Elegia in Obitum Jacobi Pacifici, Magnæ Britanniæ, Franciæ, et Hiberniæ Regis, Fideique Defensoris." Lond. 1625, 4to. Lauder has stated that he returned to his native country in 1632, and continued for some years to reside at Aberdeen; but Dempster,[4] who died in 1625, mentions, though with some degree of hesitation, that he had already returned at the period when he himself wrote. Benson conjectures that he was appointed physician to the king in the year 1633, but this conjecture is refuted by the title-page of one of his publications. "Elegiæ duæ; una ad Episcopum Abredonensem, de Fratris Obitu; altera de Pace rupta inter Scotos et Gallos; autore Arturo Jonstono, Medico Regio." Aberdoniæ, 1628, 4to. After an interval of a few years, he published "Parerga Arturi Jonstoni Scoti, Medici Regii." Aberd. 1632, 8vo. And at the same time appeared "Epigrammata Arturi Jonstoni Scoti, Medici Regii." Aberd. 1632, 8vo. The first of these collections he dedicated in verse to Sir John Scot, and the second to the Earl of Lauderdale. He soon afterwards published "Cantici Salomonis Paraphrasis poetica." Lond. 1633, 8vo. This paraphrase, which he dedicated to the king, is accompanied with a specimen of his version of the psalms. The specimen includes the seven penitential, and the seven consolatory psalms; the former being dedicated to Laud bishop of London, and the latter to Lesley bishop of Raphoe. Dempster mentions his having translated the psalms into very elegant elegiac verse; and it is therefore to be presumed that Johnston long delayed the publication in order to give his version all the advantage of a deliberate revisal. He next produced a collection of short poems, entitled "Musæ Aulicæ." Lond. 1635, 8vo. They are accompanied with an English translation by Sir Francis Kinaston. This little work was followed by his complete version of the psalms. "Paraphrasis poetica Psalmorum Davidis, auctore Arturo Jonstono Scoto. Accesserunt ejusdem Cantica Evangelica, Symbolum Apostolicum, Oratio Dominica, Decalogus." Aberd. 1637, 8vo. It is dedicated in elegant and panegyrical verse to the Countess Marischal. Benson supposes the work to have been printed in London during the same year; but as it was printed there in 1657, the one edition may have been confounded with the other. About the same time he lent his aid to the publication of the "Delitiæ Poetarum Scotorum hujus ævi illustrium." Amst. 1637, 2 tom. 12mo. These volumes were neatly printed by Bleau, at the expense of Sir John Scot, who himself appears in the list of contributors, and who doubtless retained the power of admitting or rejecting. Johnston has frequently been considered as the editor, from the circumstance of his having written the dedication to Scot, and prefixed the "Musarum Elogia," addressed to the same individual. His contributions are more extensive than those of any other writer. The entire collection forms a conspicuous monument of the scholarship, ingenuity, and taste of our countrymen; and the poems of Johnston may safely be brought into competition with those of any other writer whose name is to be found in the catalogue of contributors.

[1] Urquhart's Discovery of a most exquisite Jewel, p. 200. Lond. 1652, 8vo.

[2] M'Crie's Life of Melville, vol. ii. p. 443.

[3] Duellum Poeticum, contendentibus Georgio Eglisemmio, Medico Regio, et Georgio Buchanano, Regio Præceptore, pro Dignitate Paraphraseos Psalmi centesimi quarti. Adjectis Prophylacticis adversus Andreæ Melvini Cavillum in Aram Regiam, aliisque Epigrammatis. Lond. 1618, 4to.—Among other works, Eglisham published "Prodromus Vindictæ in Ducem Buckinghamiæ, pro virulenta Cæde potentissimi Magnæ Britanniæ Regis Jacobi; nec-non Marchionis Hamiltonii, ac aliorum virorum principum." Francofurti, 1626, 4to. Sir Henry Wotton has stated that this work was "published and printed in divers languages," about the time of the king's death. (Reliquiæ Wottonianæ, p. 554.) There is an English edition of a more recent date. "The Fore-runner of Revenge: being two Petitions," &c. Lond. 1642, 4to.

[4] Dempsteri Historia Ecclesiastica Gentis Scotorum, p. 393.

On the 24th of June 1637, Johnston was elected rector of King's College, Aberdeen. The appointment is annual, and is considered as honourable. Dr Johnson, who describes him as principal of Marischal College,[1] must apparently have been misled by his imperfect recollection of this academical office; nor is this the only mistake into which he has fallen with respect to the same university. Thus, for example, he makes the extraordinary statement that "whoever is a master may, if he pleases, immediately become a doctor." In this city Johnston appears to have had many learned and distinguished friends, of whom we find various memorials in his works. Among these was the worthy bishop of the diocese, Patrick Forbes, who, like himself, was descended from the noble family of that name; the bishop's son, John Forbes, professor of divinity in King's College; William Forbes, principal of Marischal College, and afterwards bishop of Edinburgh; Robert Baron, professor of divinity in the same college, and afterwards bishop elect of Orkney; and David Wedderburn, professor of humanity in King's, and rector of the grammar school of Aberdeen.[2] This was indeed a brilliant era in the history of the university. Dr Baron, a great adept in scholastic philosophy and theology, seems to have enjoyed a large share of his esteem, and is highly extolled in his verses. Wedderburn was the companion of his early youth, and, cultivating the same elegant studies, continued to be the friend of his maturest years. Johnston addressed to him a long elegy, in which he recounted some of the events of his life, and Wedderburn replied in another elegy, expressive of the same unaltered regard.

Although he probably continued to pay occasional visits to Aberdeenshire, he must have chiefly resided in England after the date of his appointment as physician to the king; for it is evident from some of his verses that this appointment was not merely honorary, but required his attendance at court. In his native county he appears to have acquired some real property: under the great seal, 12 June 1629, there is a charter of confirmation, in his favour, of the lands of New Leslie in the parish of Alford. Soon after his return from the continent, he was engaged in a lawsuit before the court of session; and of advocates and attornies his experience seems to have led him to form no very favourable opinion. But his career, which was sufficiently brilliant, was not destined to be long: at the age of fifty-four, he died at Oxford in the year 1641, while on a visit to one of his daughters, who was married to a clergyman of the established church. His death was affectionately bewailed by his learned friend Wedderburn, whose *Suspiria* were printed at Aberdeen during the same year.

Johnston possessed a masterly command of Latin diction; and to this attainment he added great skill in the art of versification. He was likewise distinguished by no mean portion of poetical feeling and fancy, united with an elegant and classical taste. Although it cannot be affirmed that he never employs a word or phrase which does not belong to the best age of Latinity, his diction generally displays a great degree of purity;[3] and his ear had attained to exquisite nicety in the harmony of Roman numbers, particularly those of hexameter and pentameter verse. Such was his predilection for this combined metre, that he introduced it into almost all his compositions; and even his satires are written in the elegiac measure. His poems are very numerous, and are sufficiently miscellaneous. Some of them are obscure, not from the nature of the composition, but from their abounding in allusions to persons and circumstances not easily traced or recognized. Many of his epigrams are well turned; and his satirical powers are conspicuously displayed in his poems against Eglisham, and in several others. His version of the psalms has often received, and is evidently entitled to very high commendation. After the brilliant success of Buchanan, such an attempt might justly be considered as not a little hazardous; but it cannot be asserted that Johnston had made a delusive estimate of his own powers, for if he does not surpass or equal so great a master, he at least makes a near approach to his poetic excellence. In this version, he has adhered almost uniformly to his favourite elegiac verse: it is only in the hundred and nineteenth psalm that his metre is varied, and there every part is exhibited in a new species of verse. Buchanan's plan of varying the measure according to the characteristics of the poem, was evidently more eligible in a writer who possessed such versatility of talent. The Latin paraphrases of the psalms amount to a very large number; nor do we incur much hazard in averring that the two Scottish poets have excelled all their competitors.

Dr Beattie, who has passed a general condemnation on poetical paraphrases of the psalms, is by no means disposed to exempt those of Buchanan and Johnston from this sentence. "If we look into Buchanan, what can we say, but that the learned author, with great command of Latin expression, has no true relish for the emphatick conciseness, and unadorned simplicity, of the inspired poets? Arthur Johnston is not so verbose, and has of course more vigour: but his choice of a couplet, which keeps the reader always in mind of the puerile epistles of Ovid, was singularly injudicious. As psalms may, in prose, as easily as in verse, be adapted to musick, why should we seek to force those divine strains into the measures of Roman or of modern song? He who transformed Livy into iambicks, and Virgil into monkish rhime, did not in my opinion act more absurdly. In fact, sentiments of devotion are rather depressed than elevated by the arts of the European versifier."[4] These opinions of an elegant and tasteful writer appear to be somewhat hypercritical, nor do we feel entirely disposed to acquiesce in any of the dogmas which he has thus delivered. The charge of verbosity seems to be very unadvisedly brought against Buchanan; for, to adopt the words of Ruddiman, we know of no modern poet who has "better preserved that masculine and elegant simplicity, which we so much admire in the ancient writers, and whose stile is farther removed from all gaudiness and affectation."

The reputation of Johnston did not die with himself.

[1] Johnson's Journey to the Western Islands, p. 30. "One of its ornaments is the picture of Arthur Johnston, who was principal of the college, and who holds among the Latin poets of Scotland the next place to the elegant Buchanan."

[2] Wedderburn was likewise a contributor to the "Delitiæ Poetarum Scotorum." He published the following grammatical works. "A Short Introduction to Grammar." Aberd. 1632, 8vo. "Institutiones Grammaticæ." Aberd. 1634, 8vo. "Vocabula, cum aliis Latinæ Linguæ Subsidiis:" commonly subjoined to Simson's Rudimenta Grammatices. See Ruddiman's Bibliotheca Romana, p. 62. Vossius addresses Wedderburn as "homo eruditissimus, beneque promerens de studiis juventutis." (Epistolæ, p. 304. Lond. 1690, fol.) His merit as a grammarian is highly extolled in David Leitch's "Philosophia illachrymans, hoc est, Querela Philosophiæ, et Philosophorum Scotorum (præsertim vero Borealium) oratorie expressa." Aberdoniæ, 1637, 4to. His posthumous edition of Persius was published by his brother Alexander. "Persius enucleatus: sive Commentarius exactissimus et maxime perspicuus in Persium, poetarum omnium difficillimum, studio Davidis Wedderburni, Scoti, Abredonensis. Opus posthumum." Amst. 1664, 12mo.

[3] "Arturus Jonstonus," says Morhof, "in psalmorum versione, quemadmodum et in operibus ceteris, ubique purus et tersus est, ut ego quidem nihil in illo desiderare possim." (Polyhistor, tom. i. p. 1066.) Some objectionable words and phrases, used by Johnston, are enumerated in Ruddiman's Vindication of Buchanan, p. 70.

[4] Beattie's Dissertations, Moral and Critical, p. 645. Lond. 1783, 4to.

Soon after his death, a collection of his poems was published under the superintendence of William Spang, minister of the Scotish church at Campvere, whose name is well known to the readers of Baillie's Letters. "Arturi Jonstoni Scoti, Medici Regii, Poemata omnia." Middelb. Zeland. 1642, 16to. This collection, which is printed in a very diminutive form, includes his version of the psalms, and the various works which have already been enumerated, together with some shorter poems published for the first time. It was followed by "Arturi Jonstoni Scoti Psalmorum Davidis Paraphrasis poetica, nunc demum castigatius edita." Amst. 1706, 12mo. The editor was David Hoogstratan, well-known for his edition of Phædrus; and the volume is inscribed to Janus Broukhusius, an eminent scholar, at whose suggestion the edition was undertaken. After a short interval, Ruddiman published "Cantici Solomonis Paraphrasis poetica, Arthuro Jonstono Scoto, Medico Regio, auctore: editio nova, summo studio recognita, ac notis illustrata." Edinb. 1709, 4to. Edinb. 1717, 8vo. Johnston found a more zealous admirer in William Lauder, who inserted his sacred poems in a collection entitled "Poetarum Scotorum Musæ Sacræ: sive quatuor Sacri Codicis Scriptorum, Davidis et Solomonis, Jobi et Jeremiæ, Poetici Libri, per totidem Scotos, Arct. Jonstonum et Jo. Kerrum, P. Adamsonum et G. Hogæum, Latino carmine redditi: quibus, ob argumenti similitudinem, adnectuntur alia, Scotorum itidem, Opuscula Sacra." Edinb. 1739, 2 tom. 8vo. The first volume contains a life of Johnston, together with the testimonies of various learned writers.[1] His paraphrase was also published separately; and the editor obtained from the general assembly a recommendation that it should be taught in the lower forms of grammar schools, as a precursor to that of Buchanan. An elegant edition of the latter, "cum notis variorum," had been published in 1737 by Robert Hunter and John Love, the one professor of Greek at Edinburgh, and the other master of Dalkeith school. Love now thought it incumbent upon him to extol Buchanan, and to censure Johnston; Lauder was far from being satisfied with his criticisms, and an acrimonious controversy ensued between them. Johnston's cause was espoused with great warmth by Mr Benson, who began his operations by publishing "A Prefatory Discourse to a new Edition of the Psalms of David, translated into Latin verse by Dr Arthur Johnston, Physician to King Charles the First: to which is added, a Supplement, containing a Comparison betwixt Johnston and Buchanan." Lond. 1741, 8vo. This precursor was speedily followed by "Arturi Jonstoni Psalmi Davidici, interpretatione, argumentis, notisque illustrati, in usum Serenissimi Principis." Lond. 1741, 4to. & 8vo. Each of these editions is elegantly printed, and contains a portrait of Johnston, engraved by G. Vertue. The life of the poet, we are informed, was translated into Latin by Dr Ward, professor of rhetoric in Gresham College;[2] and it may be conjectured that he also lent his aid in the preparation of the notes and interpretation, which are modelled on those of the editions for the use of the Dauphin. Not satisfied with the honour thus paid to a favourite poet, he soon afterwards published "Arturi Jonstoni Psalmi Davidici, cum Metaphrasi Græca Jacobi Duporti, Græcæ Linguæ apud Cantabrigienses Exprofessoris Regii." Lond. 1742, 8vo.[3] This volume is without preface or annotations; nor is the name of Benson appended to any of these publications. The learned Ruddiman, who was roused to some degree of indignation by his disparaging animadversions on Buchanan, prepared an elaborate volume, consisting of nearly four hundred pages, and bearing the following copious title: "A Vindication of Mr George Buchanan's Paraphrase of the Book of Psalms, from the Objections rais'd against it by William Benson, Esq. Auditor in Exchequer, in the Supplement and Conclusion he has annex'd to his Prefatory Discourse to his new Edition of Dr Arthur Johnston's Version of that sacred book: in which also, upon a comparison of the performances of those two poets, the superiority is demonstrated to belong to Buchanan: wherein likewise several passages of the original are occasionally illustrated: together with some useful observations concerning the Latin Poetry and Arts of Versification: in a Letter to that learned Gentleman." Edinb. 1745, 8vo. This volume, which displays a masterly knowledge of the Latin language and literature, may still be read for the valuable information which it contains. Although he gives a decided preference to Buchanan, he is far from being insensible to the eminent merit of Johnston, on whom he here bestows no mean commendation. "I have as high an opinion of Dr Johnston's extraordinary genius as most men have, at least as I think it ought to have; and am satisfied that, for the elegancy and purity of his diction, the sweetness and smoothness of his verse, in short all the other ingredients that are required to the composition of a great and masterly poet, he was inferior to none, and superior to most of the age he lived in. Nay, I will allow farther that, in my judgment, he deserves the preference to the far greater part of those that have lived since or before him." And in the last work which he gave to the public, he speaks of him in terms of warm and discriminating praise. "The other I shall name is Dr Arthur Johnston, physician to King Charles I., whom I will not be so foolish as, with Mr Auditor Benson, to exalt above the poets of the Augustan age, or even to prefer him to Buchanan, but this I can and will say, that tho' some few of them may have more of pomp and grandeur, of force and energy in their poetry, yet for the sweetness and smoothness, the delicacy and harmoniousness of his numbers, he is not to be equalled in any nation since Ovid's time."[4]

His youngest brother, William Johnston, M. D. is mentioned by Urquhart as "a good poet in Latine, and a good mathematician." He was educated in Marischal College, Aberdeen, and afterwards visited several foreign universities. He successively taught humanity and philosophy in the university of Sedan, where he is said to have acquired much reputation.[5] In the year 1626 he

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[1] Lauder and Benson have both overlooked the testimony of Olaus Borrichius, a learned Dane, which is highly favourable, and which commences thus: "In Arturo Jonstono Scoto, medico regio, redivivum agnoscimus Buchananum, ita non modo divinum Psalten nova et speciosa veste poetica induit, sed et in seriis jocisque, in laudibus et insectationibus, immo, quocunque stylum vertit, floridus est, copiosus, disertusque, nec usquam exemplorum inops, aut scaber. Onopordum quendam, in Musas Buchanani temerario judicio involantem, ita depexum reddidit amarissimis, sed una suavissimis elegis, ut quivis malit esse Thersites in Græcia, quam in Britannia Onopordus." (Dissertationes Academicæ de Poetis, p. 152. Francof. 1683, 4to.)

[2] Nichols's Literary Anecdotes of the eighteenth Century, vol. v. p. 522.

[3] Buchanan's paraphrase was published in a similar manner. "Psalmorum Davidicorum Metaphrasis, Græcis versibus contexta per Jacobum Duportum Cantabrigiensem: cui in oppositis paginis respondens accessit Paraphrasis poetica Latina, auctore Georgio Buchanano Scoto: utræque summa cura recognitæ et castigatæ." Lond. 1742, 8vo. The preface, subscribed R. R. is dated "Westmonasterii, viii. Cal. Aprilis, 1742." The editor has added a single note, which relates to Buchanan's dedication, and to the four verses which Atterbury proposed to substitute for the conclusion.

[4] Ruddiman's Further Vindication of his Edition of Buchanan's Works, p. 53. Edinb. 1756, 8vo.

[5] Gul. Smith Oratio in qua inclytæ Academiæ Marischallanæ Abredonensis nobilissimus Parens, illustres Mæcenates, et eximii Benefactores, ad annum M.DC.XCVI. commemorantur, p. 24. Abredeis, 1702, 4to. Andrew Strachan, a professor of King's College,

was appointed professor of mathematics in Marischal College, and here he continued till the time of his death, which took place on the 15th of June 1640.[1] With his academical labours he probably combined the practice of physic; and his circumstances were so prosperous that he purchased the estate of Beidelstone in the parish of Dyce and county of Aberdeen. By his wife, who was the youngest daughter of Abraham Forbes of Blackstoune, he left a son and two daughters.

Another Latin poet, John Johnston, was likewise connected with this family. He was the son of Johnston of Crimond in Aberdeenshire; and after completing the usual course in King's College, he prosecuted his studies on the continent, where he continued to reside for the space of eight years. He successively studied in the universities of Helmstadt, Rostock, and Geneva. After having visited England, he at length returned to his native country, and in 1593 was appointed professor of divinity in the university of St Andrews, where he was associated with Andrew Melville. He married Catharine Melville, of the family of Carnbee, and lived to lament her loss, and that of two children. He died on the 20th of October 1611.[2] Among other works, he published the two following. "Inscriptiones Historicæ Regum Scotorum, continuata annorum serie a Fergusio primo regni conditore ad nostra tempora; Joh. Jonstono Abredonense Scoto authore. Præfixus est Gathelus, sive de Gentis Origine Fragmentum An. Melvini." Amst. 1602, 4to. "Heroes ex omni Historia Scotica lectissimi, auctore Johan. Jonstono Abredonense Scoto." Lugd. Bat. 1603, 4to. Both works consist of short inscriptions, written in elegiac verse, and exhibiting a vein of ancient simplicity. Besides a prose work, entitled *Consolatio Christiana*, he is likewise the author of some sacred poems, printed at Saumur in 1611.[3]

John Johnston, M. D. must not be confounded with the professor of divinity. He was born at Sambter in Poland, on the 3d of September 1603, but was descended of Scottish ancestors; who, according to his continental biographers, were of "the illustrious family of Johnston of Crogborn,"[4] meaning perhaps Craigsburn. His native country was formerly replenished with Scottish emigrants; and during the seventeenth century, as we are assured by Lithgow, it contained no fewer than thirty thousand Scottish families.[5] Part of his education he received at St Andrews, and he afterwards prosecuted his studies in several other universities. On returning to Poland in 1632, he was engaged to accompany two young gentlemen on their travels; and, during a period of four years and a half, they visited France, Italy, and various other countries. He took his doctor's degree at Leyden, and was admitted *ad eundem* at Cambridge. The unsettled state of his own country induced him to seek another place of abode; and he withdrew to the duchy of Lignitz in lower Silesia, where he purchased the estate of Ziebendorf, and united the practice of physic with a variety of learned pursuits. By his writings he acquired so much reputation, that he was successively offered a medical chair in the university of Frankfort and in that of Leyden; but preferring a more retired mode of life, he continued to reside at his own seat till the period of his death, which took place on the 8th of June 1675. His remains were interred at Lessno in Poland on the 30th of September. Johnston was twice married, and by his second wife had several children. The most elaborate of his works bears the title of *Historia Naturalis*, and is divided into five volumes folio. His other publications, which amount to a very considerable number, chiefly relate to natural history and medicine. He published a short compendium of civil history, entitled *Polyhistor*, and a treatise "De Festis Hebræorum et Græcorum." (x.)

JOHNSTONE, Robert, is a Scotish historian of considerable reputation, but his personal history is very imperfectly known. We are however informed that he was the son of an honest burgess of Edinburgh, and that he was educated in the university of his native city.[6] He took the degree of A. M. in the year 1587. His father may perhaps have been a native of Annandale, where Johnstone is still a prevalent name. The son bequeathed legacies to some of his cousins in Annandale, L.500 sterling in trust to Lord Johnstone for building a bridge over the river Annan, and L.1000 in trust to the same nobleman for the maintenance of a grammar school at Moffat. Whether he prosecuted his studies in some foreign university, and there took his degree of LL. D., we are not informed. He appears to have fixed his residence in London, and to have inherited or acquired a considerable fortune. Dempster, to whom we are indebted for many scattered notices of Scotish writers, has stated that he was particularly esteemed by Lord Bruce of Kinloss, and, although not a courtier, that he was acceptable to King James.[7] His testament, extracted from the register of the prerogative court of Canterbury, has lately been printed, and reflects some additional light upon his history.[8] He there describes himself as "Robert Johnstone, of the parish of St Anne, Blackfryers, London, Esquire." The codicil is dated on the 12th of October 1639, and probate was granted to one of his executors six days afterwards; so that the testator must have died in that interval. The greatest part of his property he bequeathed to charitable and benevolent purposes. It is however to be suspected that his laudable intentions were in some cases frustrated: the bridge was never built over the Annan, nor did Moffat school derive much benefit from his legacy. He had been appointed one of the executors of George Heriot; and he bequeathed L.1100 to the hospital. He bequeathed L.1000 "towards the maintenance of eight poor scholars" in the university of Edinburgh. The destination of his library is thus expressed: "As for my books, I do appoint the books of humanity, Thesaurus Linguæ Latinæ, and Lexicon Græcum, to be sent unto Moffat in Annandale, when the aforesaid school is ereckted, with the Latin poets and commentaries: as for the Italian, French, and Spanish books, I would have them changed for books of philosophy, to be sent unto the College of Edinburgh: for my civil law books, and books of

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speaks of Dr Johnston in the following terms: "De Gulielmo certe idem usurpare possumus, quod olim de Tito Imperat. suavissimo dictum est, *Deliciæ est humani generis*; tanta est ejus comitas, tanta urbanitas." (Panegyricus Inauguralis, quo Autores, Vindices, et Evergetæ illustris Universitatis Aberdonensis justis elogiis ornabantur, p. 22. Aberdoniis, 1631, 4to.)

[1] Spalding's History of the Troubles in Scotland, vol. i. p. 215.

[2] His testament may be found in the Miscellany of the Maitland Club, vol. i. p. 333.

[3] See Dr M'Crie's Life of Melville, vol. ii. p. 512.

[4] Sagittarii Introductio in Historiam Ecclesiasticam, tom. i. p. 217. Jenæ, 1718, 2 tom. 4to. Niceron, Mémoires pour servir à l'Histoire des Hommes illustres dans la Republique des Lettres, tom. xli. p. 269.

[5] Lithgow's Nineteen Years Travels, p. 402.

[6] Crawford's History of the University of Edinburgh, p. 140.

[7] "Robertus Johnstonus, Baroni Killosensi dum vivebat carus, vir variæ lectionis, raræ eruditionis, scripsit Historiam sui Seculi Latine, lib. i. et tersissimam, ut est limati judicii. Vivit adhuc Londini virtutis merito, licet non aulicus, regi acceptus." (Dempsteri Historia Ecclesiastica Gentis Scotorum, p. 394.)

[8] Constable's Memoirs of George Heriot, p. 163. Edinb. 1822, 8vo.

history, I give also to the said College of Edinburgh; and my English books I give unto my said servant Hendry Heron."

Dr Johnstone had prepared a history of his own time; and the earliest part of it, consisting of two books, appeared under the title of "Historiarum libri duo, continentes Rerum Britannicarum vicinarumque Regionum Historias maxime memorabiles. Sunt præter hos adhuc xx. libri, qui typographo nondum in manus venere." Amst. 1642, 12mo. It contains the author's dedication to King Charles, and the subsequent epigram, "Ad Robertum Johnstonum Scoto-Britannum," written by John Owen:

> Ingenii, Johnstone, tui sum factus amator,
> Historiæ legerem dum monumenta tuæ.
> Nil magis ingenuum, nihil ingeniosius extat
> Tergeminæ Britonum gentis in historia:
> Excipias unum Morum de rege Ricardo,
> Nemo Britannorum dignior invidia.

Such portions of the volume as relate to Scotish history were soon afterwards translated into English: "The Historie of Scotland during the Minority of King Iames: written in Latine by Robert Johnston: done into English by T. M."[1] Lond. 1646, 12mo. This translator was perhaps Thomas Middleton, author of the Appendix to Spotswood's History. The identity of the historian and of the individual who died in 1639, is established by the testimony of the translator, who mentions his author's bequest to the university of Edinburgh. He has however magnified the eight exhibitions into eight fellowships. The entire history at length made its appearance in an ample volume: "Historia Rerum Britannicarum, ut et multarum Galli carum, Belgicarum, et Germanicarum, tam politicarum quam ecclesiasticarum, ab anno 1572 ad annum 1628." Amst. 1655, fol. The editor, under the signature of J. S. has prefixed a very brief notice, which contains an erroneous statement of the author having himself published the first two books. Buchanan's history, according to the opinion of Nicolson, has been "continu'd in the same fine language" by Johnstone;[2] and Lord Woodhouselee describes this continuation as "a work of great merit, whether we consider the judicious structure of the narrative, the sagacity of the reflections, the acute discernment of characters, or the classical tincture of the style. In those passages of his history where there is room for a display of eloquence, he is often singularly happy in touching those characteristic circumstances which present the picture strongly to the mind of the reader, without a vain parade of words, or artificial refinement of sentiment."[3] Of this high commendation we are however disposed to make some abatement, both as to the matter and style of Johnstone's history. (x.)

JOHNSTONE, a modern and thriving village of Scotland, in the county of Renfrew, at the distance of about three miles west from Paisley. It owes its origin entirely to manufactures, as about forty years ago only a few cottages stood where now is seen a town consisting of two large squares, many considerable streets, and public works. It is regularly laid out, there being one main street, which is crossed by others at right angles. The houses are substantially built, and for the most part two stories high. There are within the precincts of the place seventeen cotton mills of various extent, and other three in the neighbourbood. There are also in the town two brass and two extensive iron founderies; five machine manufactories, and a public gas-work. Besides a chapel of ease belonging to the Scotch church, there is here a United Secession and Relief church, a Universalist, and Methodist chapel. In Johnstone are also a town school, a subscription library, two news-rooms, a mechanics' institution and library, and sundry benevolent and religious societies. The Ardrossan Canal from Glasgow terminates in a basin at the east end of the town. In its neighbourhood are four collieries, which are of great advantage to a place to which coal is of essential importance. The population in 1811 amounted to 3647, and in 1818 to 5000.

JOHNSTON'S Isle, a small island in the Eastern Seas, surrounded by a cluster of others. It is covered with verdure and cocoa-nut trees. Long. 131. 12. E. Lat. 3. 11. N.

JOHORE, a town of Malacca, and capital of an independent Malay principality, situated near the southern extremity of the peninsula of Malacca, twenty miles up a river of the same name. It was founded in 1511 by the inhabitants of Malacca, who fled thither on the capture of their city by the Portuguese. In 1603 Johore was also taken by the Portuguese, but rebuilt a little higher up the river. The surrounding country abounds in pepper, tin, gold, sago, and elephants' teeth. The inhabitants bring these articles in their own prows to Prince of Wales' Island, and receive in return opium and other goods. Long. 104. 5. E. Lat. 1. 40. N.

JOIGNY, an arrondissement of the department of the Yonne, in France. It extends over 774 square miles, is divided into nine cantons, and these into 110 communes, having a population of 78,687 persons. The capital, from which the circle takes its name, is a city on a hill, rising from the banks of the river Yonne. It is surrounded with walls, has a fine market-place, and 1000 houses, with 5176 inhabitants. There are some manufactures of cloth and of leather. Long. 3. 55. E. Lat. 47. 50. N.

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[1] This translation occurs in a volume entitled *Scotia Rediviva*, a Collection of Tracts illustrative of the History and Antiquities of Scotland, p. 361. Edinb. 1826, 8vo.

[2] Nicolson's Scottish Historical Library, p. 121.

[3] Woodhouselee's Memoirs of Lord Kames, vol. i. app. p. 3.

JOINERY.

Is one of the useful arts which contributes most materially to the comfort and convenience of man. As the arts of joinery and carpentry are often followed by the same individual, it appears, at first view, natural to conclude, that the same principles are common to both these arts. But a closer examination of their objects leads us to a different conclusion.

arpentry fined.

The art of Carpentry is directed almost wholly to the support of weight or pressure; and, therefore, its principles must be found in the mechanical sciences. In a building, it includes all the rough timber-work necessary for support, division, or connection; and its proper object is to give firmness and stability. See the Article Carpentry.

oinery fined.

The art of Joinery has for its object the addition in a building of all the fixed wood-work necessary for convenience or ornament.. It is the *Intestinum opus* of Vitruvius, and the *Menuiserie des bâtimens* of the French.

The joiner's works are many of them of a complicated nature, and require to be executed in an expensive material; therefore joinery requires much skill in that part of geometrical science which treats of the projection and description of lines, surfaces, and solids, as well as an intimate knowledge of the structure and nature of wood.

It may also be remarked, that the rough labour of the carpenter renders him in some degree unfit to produce that kind of accurate and neat workmanship which is expected from a modern joiner.

rogress of oinery in ngland.

In early times, very little that resembles modern joinery was known; every part was rude, and joined in the most artless manner. The first dawnings of the art appear in the thrones, stalls, pulpits, and screens of our cathedrals and churches; but, even in these, it is of the most simple kind, and is indebted to the carver for every thing that is worthy of regard. Whether in these monuments, the carver and the joiner had been one and the same person we cannot now determine, though we imagine, from the mode of joining in some of them, that this was the case.

During several centuries joinery seems to have been gradually improving, but nothing appears to have been written on the art before 1677, when Mr Joseph Moxon, a Fellow of the Royal Society, published a work, entitled *Mechanick Exercises*, or the *Doctrine of Handyworks.* In this work the tools, and common operations in joinery, are described, with a collection of the terms then in use. It must have been a valuable work at that time, but to a master in the art it would convey little if any thing that was new. Sash-windows were introduced into England some time before the date of Moxon's work, but he has not noticed them. According to the observations of Dr Thomson this important improvement has not yet found its way into Sweden.[1]

About the beginning of the last century several works of a most interesting kind made their appearance. Forms began to be introduced in architecture, which could not be executed at a moderate expense without the aid of new principles, and these principles were discovered and published by practical joiners. As might naturally be expected, these authors had but confused notions, with a scanty portion of geometrical knowledge; and, accordingly, their descriptions are often obscure, and sometimes erroneous.

The hand-rails of stairs offered many difficulties, and an imperfect attempt to remove them was first made by Halfpenny, in his *Art of Sound Building*, published in 1725. Price, the author of the *British Carpenter*, published in 1733, was more successful, and his remarks show a considerable degree of knowledge of the true nature and object of his researches.

The publication of Price's work must have produced a considerable sensation among joiners, for it was soon followed by many other works of different degrees of merit. Of these the works of Langley and Pain were the most popular.

The establishment of the principles of joinery, on the sound basis of geometrical science, was reserved for Nicholson. In his *Carpenters' Guide*, and *Carpenter and Joiners' Assistant*, published in 1792, he has made some most valuable corrections and additions to the labours of his predecessors.

Corresponding improvements were also made in the practice of joinery, for which we are much indebted to the late Mr James Wyatt. This celebrated architect kept together some of the best workmen in London, who were looked up to with a degree of emulation by young men, which had a beneficial effect on the progress of joinery. But the art is still far short of perfection. We conceive that many of those operations, on which the soundness of work chiefly depends, might be done with greater exactness, and less labour, by means of tools contrived for these purposes. The truth and certainty which have been introduced in block-making, is sufficient to encourage some one to extend the same manner of mortising in joinery. See Block-Machinery.

Progress of Joinery in France.

The principles of joinery were cultivated in France by a very different class of writers. In the extensive work of Frezier, entitled *Coupé des Pierres et des Bois*, 3 vols. 4to, 1739, all the leading principles are given and explained with tedious minuteness, offering a striking contrast to the brevity of our English writers. The first elementary work on that part of geometrical science, which contains the principles of joinery, appeared in France in 1705, from the pen of the celebrated Gaspard Monge, who gave it the name of *Géométrie Descriptive.* Much of what has been given as new in English works, had been long known on the Continent; but there does not appear to have been much, if any, assistance derived from these foreign works by any writer prior to Nicholson.

The latest French work which treats of joinery is Rondelet's *L'Art de Bâtir.* It is also the best foreign work on the subject that we have seen; but it is not at all adapted to the state of joinery in England. In practice, the French joiners are very much inferior to our own Their work is rough, slovenly, and often clumsy, and at the best is confined to external effect. The neatness, soundness, and accuracy, which is common to every part of the works of an English joiner, is scarcely to be found in any part of the works of a French one. The little correspondence, in point of excellence, between their theory and practice, leads us to think that their theoretical knowledge is confined to architects, engineers, &c. instead of being diffused among workmen, as it is in this country.

In cabinet-work the French workmen are certainly superior, at least as far as regards external appearance; but when use, as well as ornament, is to be considered, our own countrymen must as certainly carry away the palm.

[1] *Travels in Sweden*, p. 8.

Joinery.

The appearance of French furniture is much indebted to a superior method of polishing, which is now generally known in this country.[1] For many purposes, however, copal varnish (such as coachmakers use) is preferable; it is more durable, and bears an excellent polish.

Geometrical knowledge necessary.

Geometry is useful in all, and absolutely necessary in some, parts of a joiner's business; but it is absurd to encounter difficulties in execution, and to sacrifice good taste, convenience, economy, and comfort, merely for the purpose of displaying a little skill in that science. It is, however, a common fault among such architects as are better acquainted with geometrical rules than with the production of visible beauties, to form designs for no other purpose than to create difficulties in the execution.

But, when geometrical science is properly directed, it gives the mind so clear a conception of the thing to be executed, that the most intricate piece of work may be conducted with all the accuracy it requires.

Practice of Joinery.

The practice of joinery is best learned by observing the methods of good workmen, and endeavouring to imitate them. But the sooner a workman begins to think for himself the better; he ought always to endeavour to improve on the processes of others; either so as to produce the same effect with less labour, or to produce better work.[2]

We intend, in this article, to give a plain and simple exposition of the most valuable principles of the art of joinery, which will, we hope, place many parts of the practice under a new point of view, and ultimately tend to improve them.

Cabinet-Making.

Cabinet-making, or that part of the art of working in wood which is applied to furniture, has little affinity with joinery, though the same materials and tools be employed in both. Correctness and strict uniformity are not so essential in moveables as in the fixed parts of buildings; they are also more under the dominion of fashion, and therefore are not so confined by rules as the parts of buildings.

Cabinet-making offers considerable scope for taste in beautiful forms, and also in the choice and arrangement of coloured woods. It requires considerable knowledge in perspective, and also that the artist should be able to sketch with freedom and precision.

If the cabinet-maker intend to follow the higher departments of his art, it will be necessary to study the different kinds of architecture, in order to make himself acquainted with their peculiarities, so as to impress his works with the same character as the rooms they are to furnish.

In as far as regards materials, and the principles of joining work, the cabinet-maker will find some useful information in the second and third sections of this article. In ornamental composition he may derive much benefit from Tatham's *Etchings of Ancient Ornamental Architecture*, London, 1799; Percier and Fontaine's *Recueil des Décorations Intérieures comprenant tout ce qui a rapport à l'Ameublement*, Paris, 1812; and, for general information, the *Cabinet Dictionary*, and the *Cabinet-Maker and Upholsterer's Drawing-Book* of Sheraton, may be consulted.

Sect. I.—On making Working Drawings.

1. In this section we propose to lay before the reader the most important part of the principles of describing, on a plane surface, the lines necessary for determining bevels, forming moulds, or any other purpose required in the practice of joinery. The limits within which such an article as joinery must be confined, in a work like this, will not permit us to enter much into detail on the various points to be illustrated in this section; but we hope, by judicious selection, to place under one point of view the principles that are most useful to the joiner.

Projection of Bodies.

Nature of Projection illustrated.

2. A clear idea of the nature of projection is so essential in making working drawings, that, in our endeavours to illustrate it, we cannot proceed upon principles too simple. In the first stage of such an inquiry, experiment furnishes at once the most clear and satisfactory evidence, particularly to those who are not familiar with mathematical subjects.

If some small pieces of wood, or pieces of wire, were joined together, so as to represent the form of a solid body, a cube for example, and if this figure were held between the sun and the surface of a plane board, then the shadow of the figure upon the board would be its projection upon that plane. From this simple experiment, it will appear, that the projection of any line placed in the direction of the sun's rays will be a point: the projection of any line parallel to the plane will be of the same length as the line itself, and the projection of any line inclined to the plane will be always shorter than that line.

3. We have supposed the board to be placed at any angle with the direction of the rays of the sun; but, for our present purpose, it is sufficient to consider them to fall perpendicularly upon it; hence it is obvious, that to project a straight line upon a plane, a perpendicular to the plane should be let fall from each end of the line, and the line joining the points where the perpendiculars meet the plane will be the projection required.

When a projection is made upon a horizontal plane, it is usually called a *plan* of the body. When the projection is upon a vertical plane, it may be an *elevation* or a *section* of the body; it is a section when a portion is supposed to be cut off; and the plane of projection is usually parallel to the plane of the section.

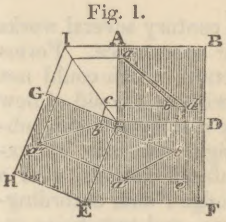
4. Bodies may be divided into three classes, according to the kinds of surfaces by which they are bounded. The first class, comprehending those which are bounded by plane surfaces, such are cubes, prisms, pyramids, and the like. The second class contains those which are bounded in part by plane surfaces, and the rest by curved surfaces, as cylinders, cones, &c. The third, including those which are bounded by curved surfaces only, as spheres, spheroids, &c.

The projections of the first class of bodies will consist of straight lines; those of the second class, of curved as well as straight lines; and those of the third class, of curved lines only.

Projection of lines.

4. Let ABCD, and CDEF, Fig. 1, be two plane surfaces, connected by a joint at CD, so that while the plane CDEF remains horizontal, the plane ABCD may be placed perpendicular to it, and thus represent a vertical plane. Then, if a line be so placed in space that ab is its projection on the vertical plane, and $a'b'$ its projection on the horizontal plane, its projection on any other vertical plane, HGEC, may be determined. This is easily effected, for we have seen, that if a perpendicular be drawn

Fig. 1.



[1] The method of making and using the French polish is minutely described in Dr Thomson's *Annals of Philosophy*, vol. xi. p. 119 and 371.

[2] Descriptions of the tools, with instructions for using them, may be found in Moxon's work before quoted, and in Nicholson's *Mechanical Exercises*, Taylor, London, 1812.

 to the plane from each end of the given line, they will give the positions of the ends of the line in the projection (Art. 3). Now, the same thing will be done, by drawing $a'a''$ and $b'b''$ perpendicular to EC, and setting off the points a'' and b'' at the same height above EC respectively, as a and b are above CD, then the line $a''b''$ is the projection required.

The heights may be transferred from one vertical plane to another when they are both supposed to be laid flat, by drawing the line IC, so as to bisect the angle ECD, and if cb be parallel to CD, meeting IC in c, then a line drawn parallel to EC, from the point c, will give the height of the point b'', and so may be found the height of any other point.

o determine the ngth of a ojected ne.

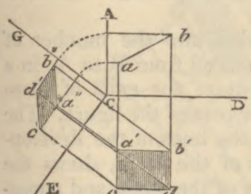
6. In the particular case we have drawn, none of the projections represents the real length of the given line. To obtain this length, draw $a'e$ parallel to CD, and with the radius ab' describe the arc $b'e$ cutting $a'e$ in e; draw de perpendicular to CD, cutting the line cb in d; join ad, and it is the length of the given line.

rojection planes.

The real lengths of lines frequently are not given, therefore another general method of finding them will be found useful, and which may be stated as follows: the length of an inclined line projected upon a plane is equal to the hypothenuse of a right-angled triangle, of which one side is the projection upon the plane, and the other side is the difference between the perpendicular distances of the extremes of the line from the plane.

7. In fig. 2, $a'b'cd$ represents the horizontal projection, or plan, of a rectangular surface, and the elevation ab shows its inclination; and its projection against another vertical plane, making any angle ECD with the former, or plane of elevation, is shown by $a''b''c'd'$. GC being perpendicular to EC, and AC perpendicular to CD, the heights may be transferred by means of arcs of circles described from C as a centre. This is a better method than that by bisecting the angle given in fig. 1; but neither of them so good, in practice, as setting of the heights with the compasses, or with a lath. In our figures it is desirable to shew the connection of corresponding parts as much as possible; therefore, the reader will bear in mind that many of the operations we describe may be done with fewer lines when the operator is fully master of his subject.

Fig. 2.



8. It may be further noticed in this place, that when a point is to be determined in one line by the intersection of another, the lines should cross each other as nearly at right angles as possible; for, when the intersecting lines cross very obliquely, a point cannot be determined with any tolerable degree of accuracy.

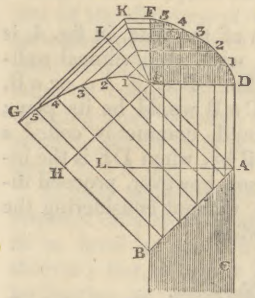
ojection curved es.

9. A curved line can seldom be projected by any other means than by finding a number of points through which the projected line must be drawn, or finding a series of tangents to the section. In giving an example of the projection of a body bounded by a curved surface, we shall select a case of frequent occurrence in practice, referring to the *Géométrie Descriptive* of Monge, for more general methods.

Let ABC be part of the plan of the base of a solid, fig. 3, and FED its end elevation; the upper side of the solid being bounded by the curved surface FD. This solid is supposed to be cut at AB by a plane perpendicular to the base, and our intention is to shew the form of the section.

Draw EH parallel to BA, and GIHE will represent the plane upon which the section is to be projected. Set off any convenient number of points, 1, 2, 3, 4, &c. in the given curve FD, from each of these points draw a line perpendicular to ED, to meet BA; and from the points in BA, thus determined, erect perpendiculars, which will cut HE at right angles. Make GH equal to FE, and set off the points 1, 2, 3, &c. in GHE at the same distances respectively from HE as the corresponding points 1, 2, 3, &c. in EFD are from the line ED. A curve being drawn through the points E, 1, 2, 3, 4, 5, G will complete the section. In large works, the joiner will often find it useful to put nails in the points, and to bend a regular lath against the nails; with the assistance of the lath, the curve may be drawn with more regularity.[1]

Fig. 3.



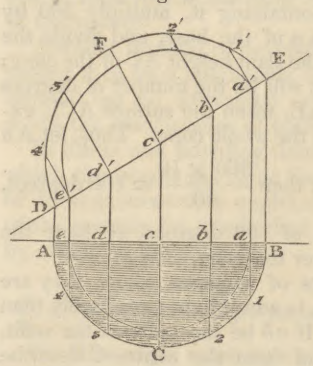
If the curve FD were very irregular, or a mixed line of straight parts and curved ones, the same method would determine the section; all the caution required is, that a sufficient number of points should be fixed upon in the given curve; and upon the proper selection of these points much of the accuracy of the section will depend.

The angle ribs of groined ceilings, the angle ribs for coved ceilings, or brackets for large cornices, and the angle cantilevers for balconies or other works of a similar kind, are found by this method. If FD be the cross rib of a groin, then GE will be the form of the corresponding angle rib. Also, if the angle of a room be represented by LAC, and FD be the cove for the ceiling, then GE will be the proper angle rib for such a cove.

In some cases, the section may be determined by means of the properties of the given curve, when the nature of that curve is known. Thus the oblique section of a cylinder is an ellipse, and the sections of a cone are certain figures depending on the direction of the plane of section (see the article Conic Sections); but if an architect were confined to the use of geometrical curves, there would be small scope, indeed, for a display of taste in his art; therefore the joiner must generally have recourse to the simple method we have described.

10. The section of a body may often be drawn by a more simple and direct process; and yet where the principle is still the same. Thus the section of the half cylinder ACB, in fig. 4, being compared with the process in fig. 3, will be found to be the same in every respect, excepting in the position of the parts of the figure. In fig. 4, ACB is the end or plan of the cylinder, and DE the inclination of the plane by which it is cut. Let the ordinates $a\,1$, $b\,2$, &c. in the plan, be drawn perpendicular to AB, and continued till they cut the inclined line DE. Also draw the ordinates $a'\,1'$, $b'\,2'$, &c. perpendicular to the line DE, and make the distances $a'\,1'$, $b'\,2'$, &c. respectively equal to the corresponding distances $a\,1$, $b\,2$, &c. upon the plan. Through the points E, $1'$, $2'$, &c. draw the curve DFE.

Fig. 4.



As the curve DFE is an ellipse, when ABC is a circle, in that case it will be better to draw an ellipse with a tram-

[1] A simple and convenient instrument for this purpose is described in the *Transactions of the Society of Arts*, for 1817, vol. xxxv. p. 109.

mel, or any other machine that produces the curve by a continued motion. (See the article ELLIPTOGRAPH.) DE is the transverse, and Fc' the semi-conjugate axis of the ellipse.

The most important application of the case, in fig. 4, is to the hand-railing of a staircase, with a curvilineal well-hole, or opening down the middle. For, if Ae, or aB, show the breadth of the rail, AeCaB would be its plan; and De'Fa'E the form of a mould, commonly called a face mould, for cutting out the rail by, when DE is the inclination of the plank. We cannot, however, proceed directly to the subject of stair-rails, without considering the development of the surfaces of bodies.

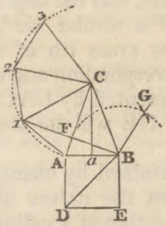
Development of Surfaces.

To develope a pyramid.

11. To develope the surface of a solid, is to draw, on some plane surface, a form that would cover it. If this form were drawn upon paper, and the paper were cut to it, the paper, so cut, ought to cover exactly the surface of the solid. Now, in joinery, it is often required that a mould should apply to a curved surface; and, therefore, the developement of that surface upon a flexible material gives the form of the mould.

The covering of a square pyramid may be found by erecting a perpendicular from the middle of one of the sides of its base, as from a in the side AB, fig. 5. Upon this perpendicular set off aC equal to the slant height of the pyramid; then, with the radius AC and centre C describe the arc A3, and set off the distance AB three times upon the arc. Join the points C3, C2, C1, CA, and CB, and draw the lines 32, 21, 1A, which determine the covering required.

Fig. 5.

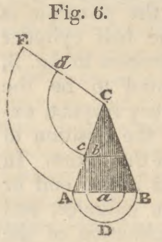


It is obvious, that we could develope a pyramid of which the base might have any number of sides, by the same method; and that a near approximation to the development of a right cone might be effected by the same means, which, in fact, is the means usually employed. But the following method of spreading out the surface of a cone will be found more correct.

To develope a cone.

12. Let ABC, fig. 6, be the elevation of a cone, and ADB half the plan of its base. With the radius AC describe the arc AE, which will be the line bounding the development; and, to find the length of the arc, or rather the angle containing it, multiply 360 by the radius Aa of the base, and divide the product by the slant height AC of the cone; the quotient will be the number of degrees in the arc AE, when the surface ACE exactly covers the whole cone. Thus, let Aa be 12 feet, and AC 40 feet; then $\frac{360 \times 12}{40} = 108$ degrees, and making ACE an angle of 108 degrees, we have the sector ACE that would cover the cone.

Fig. 6.



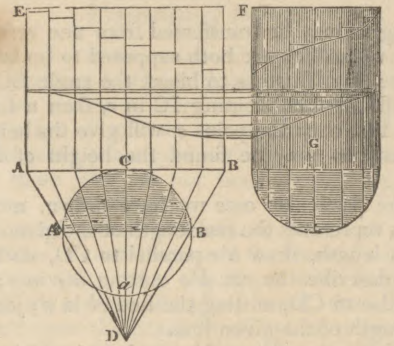
This applies to the soffits of windows, where they are enlarged towards the inside, to admit light more freely than square recesses would do. If ab be the width of the soffit, draw cb parallel to AB, and from the centre C describe the arc cd. Then half the developement AEcd will be the mould for the soffit; or the form of a veneer that would cover it.

To develope a cylinder.

13. The development of a cylinder is also of use in forming the mould for soffits, but is still more useful in the construction of stairs; and, as we are obliged to consider it as a prism with numerous sides, it is obvious that any other body of a like kind may be developed by the same means.

Let ABC, fig. 7, be the plan of half a cylinder, and A$'$E its height. Divide the curve ACB into any convenient number of equal parts, and let these parts be set off from C to A, and from C to B$'$. When the curve is a semicircle, divide the diameter AB into the proposed number of parts, and make aD equal to three-fourths of the radius. From D, through the points A and B, draw the lines DA$'$, DB$'$, then A$'$B$'$ is nearly equal to the curve ACB stretched out;[1] and, by drawing a line from D through each of the divisions in AB, the line A$'$B$'$ will be divided into the same number of equal parts.

Fig. 7.



In either case, erect a perpendicular from each point of division, and EA$'$B$'$F will be the development of the surface.

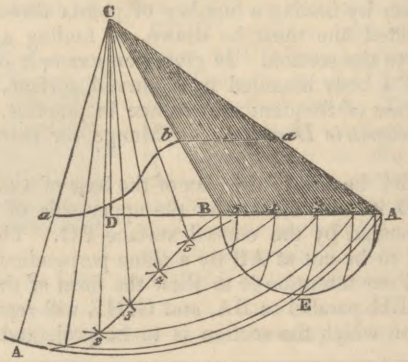
If we suppose A$'$B$'$ to be divided into the number of steps that would be necessary to ascend from B to A, in a circular staircase, the development of the ends of these steps may be drawn as in the upper part of the figure. The projection G of the cylinder, with the lines of the development drawn upon it, and the ends of the steps, shews the waving line formed by the nosings of the steps, and consequently by the hand-rail of a circular staircase.

When a part of a cylinder is cut off by a plane, the line of section will be a curved line upon the development, as is shewn in the lower part of the development, fig. 7. The faint lines shew the manner of finding the edge of the covering, and is the same as finding a mould for a soffit formed by an arch cutting obliquely into a straight wall.

14. In an oblique cone, the lines drawn on its surface, from its base to the vertex, would be of different lengths; and as those lengths are not shewn by the plan or elevation, they may be had by means of the principle stated in art. 6. To develope an oblique cone.

Let ABC, fig. 8, be the given cone, and AEB a plan of

Fig. 8.



[1] This has been shown by Dr C. Hutton, in his *Mathematical Tracts*, vol. i. p. 160.

half its base; to find the development, produce AB, and from the vertex C let fall the perpendicular CD. Divide the circumference of the base into any number of equal parts, and from each point of division describe an arc from D, as a centre, to cut the line AB at 1, 2, 3, &c. From C, as a centre, describe the arcs AA′, 11, 22, &c. and with a radius equal to one of the divisions of the circumference of the base, and the centre B cross the arc 55, which determines the point 5 in the development, with the same radius, and the point 5, as a centre cross the arc 44, and so on for the remainder of the arcs. Join A′C, and draw a curve line through the points A′, 1, 2, &c. which gives the covering for half an oblique cone.

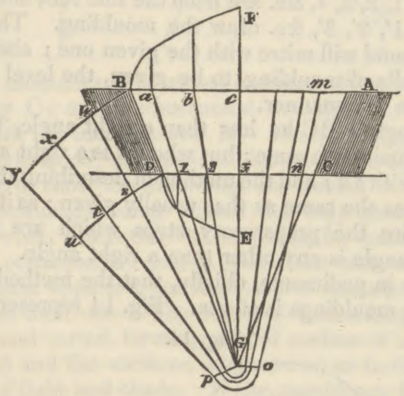
If the cone be cut by a plane, *a b*, parallel to the base, the surface B *b a′* A′ will be the covering of a soffit for a conical arch cutting obliquely into a straight wall.

find the ...ering of ...ffit.

15. As it often happens that there is not a sufficient space between the head of a door, or a window, and the cornice of the ceiling, to admit of the same bevel being preserved at the crown or top, as at the sides of the window; in such cases the soffit is made level at the crown, or with such an inclination only as will prevent the architrave cutting into the cornice of the room.

Let ABCD, fig. 9, be the plan of the space to be covered with a soffit, ED the arch of half the opening, which is

Fig. 9.



in its proper position when set perpendicularly over the line CD; and let F *c* be the height of the arch over AB. Produce AC and BD to meet at G; set off *c m* equal to *c* F, and 3 *n* equal to 3 E, then draw a line through the points *m n*, which will give the inclination of the soffit at the highest part of it. Divide the arch ED into any number of equal parts (in our example we have only divided it into three parts), and from each point of division let fall a perpendicular to CD, meeting the line CD in the points 1, 2. Through these points draw the lines G *a*, G *b*, cutting the line AB in the points *a b*, and from each point erect a perpendicular to AB. Set off, on 3 *n*, the heights of the points in the curve ED, and divide the line *m c* in the same proportion as *n* 3, which will give the corresponding heights for the arch FD, and through the points thus found the arch FD should be drawn.

Make G *o* perpendicular to GE, cutting a line passing through the points *m n* in *o*, and draw lines through the corresponding points of division in the lines *m c*, *n* 3, so that G *o* may be divided in the same proportion as *n* 3. Draw G *p* perpendicular to GD, and equal to G *o*, and set off upon it the same distances as are upon G *o*. Then, with a radius G 1, and the first division on G *p*, as a centre, describe an arc at *s*, and with a radius equal to one of the divisions of the arc ED and D as a centre, cross the arc *s*, which gives one point. Also, with a radius G 2, and the second division on G *p* as a centre, make an arc at *t*, which, being crossed by an arc described with a radius, equal to one of the divisions of the arc ED, and *s* as a centre, determines another point in the edge of the covering. Proceed in the same manner till half the development of one edge be completed; the other edge will be obtained by drawing lines through the points *s*, *t*, *u*, from the corresponding points in G *p*, and making *s w* equal to *a* 1; *t x* equal to *b* 2, &c.

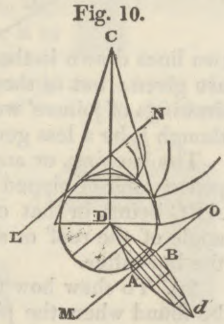
As both sides are the same, the soffit mould for one side requires only to be reversed for the other side. If the soffit be level at the crown, the process may be rendered shorter; but, where it is possible to get space for a slight inclination, the appearance of the soffit is always materially improved.

If the plan of the wall be circular, find the development of the arc ED as before, and transfer the distances from CD of the points in the curved wall, to the corresponding lines in the development, in the same manner as was done to find the edge B *w x y*.

16. The development of a sphere, or globe, can be effected only by an approximate process, as it is impossible to apply a plane surface so as to touch more than one point at a time; but various methods may be employed which are useful in forming spherical surfaces. To develope a sphere.

A sphere may be divided into numerous zones, the surface of each zone may be considered as that of the frustum of a cone, and developed in the same manner as has been described for a portion of a cone in art. 12. The upper part of fig. 10 shews half a sphere developed in this manner: and when it is divided into very narrow zones, the covering found by this process has some advantages, in practice, that are peculiar to it.

Fig. 10.



17. The surface of a sphere may also be developed by inscribing it in a cylinder, LMNO, fig. 10, and considering a small portion, or gore, ABD, to coincide with the surface of the cylinder. Then, if the portion ABD, considered as part of a cylinder, be developed by the process described in art. 13, one gore, AB *d* will be obtained; and by dividing the circumference of the sphere into any number of equal parts, and making AB equal to one of these parts, the same mould will serve for the whole of the sphere.

Another method of developing a sphere consists in supposing it to be a polyhedral, or many-sided figure; but this method has no advantage over the preceding ones, while it has the inaccuracies of both of them.

In lining and boarding domes, the position of the ribs to which the boards are to be fixed will determine the method of developement that ought to be adopted; but the form of the veneers for a spherical surface may be determined by either method.

To determine the Angle formed by two Inclined Planes.

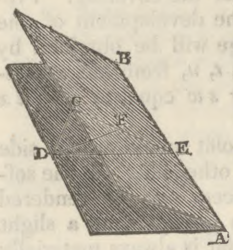
18. The angle made by two planes which cut one another, is the angle contained by two straight lines drawn from any, the same, point in the line of their common section, at right angles to that line; the one in the one plane, and the other in the other.[1] This angle is the same as that which the joiner takes with his bevel, the bevel being always applied so that its legs are square from the arris, or common section of the planes. To find the angle of planes inclined to one another.

[1] This is the definition given by Professor Playfair, in his *Elements of Geometry*, and it is better suited to our purpose than Euclid's definition.

Joinery.

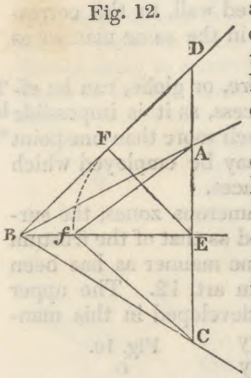
If two lines, AB and CD, be drawn upon a piece of pasteboard, at right angles to one another, crossing at the point E, and the pasteboard be cut half through, according to the line AB, so that it may turn upon that line as a joint; then, to whatever angle, CED, fig. 11, the parts may be turned, the lines EC and ED will be always in the same plane. Also, a line FD, drawn from any point D, in the line ED, to any point, F, in the line EC, will be always in the same plane. From these self-evident properties of planes, it is easy to determine the angle formed by any two planes, when two projections, or one projection and the development of the surfaces, are given.

Fig. 11.



19. Let ABC, fig. 12, be the plan of part of a pyramid, and BD the elevation of the arris, or line formed by the common section of the planes in respect to the line EB; EB being the projection of that arris upon the plan.

Fig. 12.



Draw AC perpendicular to EB, cutting it in any point E, and from E draw EF perpendicular to DB. With the radius EF, and centre E, cross EB in f, and join Af and fC, then the angle AfC is the angle formed by the planes of the pyramid.

The angle may be constructed when the plan and elevation of any two lines drawn in the planes, so as to intersect in the arris, are given; but as these projections are not often given in drawings of joiners' work, we have inserted the preceding, though it be a less general method.[1]

The backing, or angle for the back of hip-rafters in carpentry, and of hipped sky-lights, is found in this manner; ABC being, in that case, supposed to be the plan of an angle of the roof or sky-light, and DB the inclination of the hip-rafter.

20. To shew how the angle formed by two planes may be found when the plan and development are given, let it be required to find the angle contained by the two faces of a square pyramid, fig. 5.

Draw FB perpendicular to AC, and with the radius BF, and centre B, describe the arc FG. Then, with the radius DB, and centre F, cross the former arc in G, join BG, and FBG is the angle formed by two, the inclined faces of the pyramid.

Raking Mouldings.

Raking mouldings.

21. When an inclined or raking moulding is intended to join with a level moulding, at either an exterior or an interior angle, the form of the level moulding being given, it is necessary that the form of the inclined moulding should be determined, so that the corresponding parts of the surfaces of the two mouldings should meet in the same plane, this plane being the plane of the mitre. It may be otherwise expressed, by saying that the mouldings should mitre truly together.

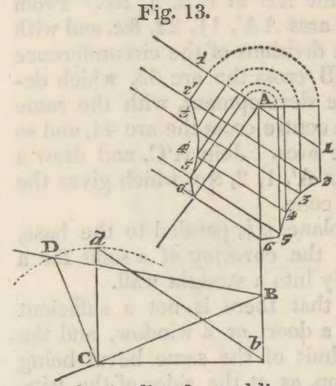
If the angle be a right angle, the method of finding the form of the inclined moulding is very easy; and as it is not very difficult for any other angle, it may perhaps be best to give a general method, and to illustrate it by examples of common occurrence.

General Method of describing a Raking Moulding, when the Angle and the Rake, or inclination of the Moulding, is given. Joinery

General method.

Let ABC, fig. 13, be the plan of the angle of a body, which is to have a level moulding on the side AB; and this level moulding is to mitre with an inclined moulding on the side BC. Also, let CBD be the angle the inclined moulding makes with a level or horizontal line BC.

Fig. 13.



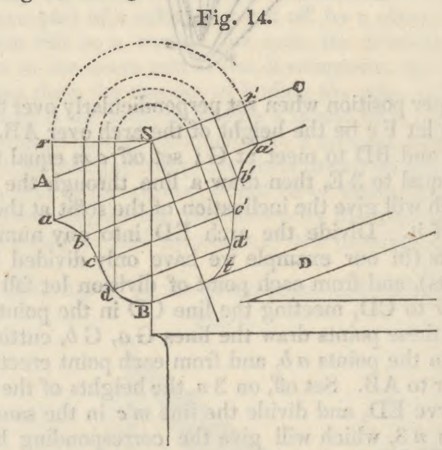
Produce AB, and draw Cb perpendicular to AB; also make DC perpendicular to BC, and dC perpendicular to bC. Set off Cd equal to CD, and join bd; then the inclined moulding must be drawn on lines parallel to bd.

Let 1, 2, 3, 4, &c. be any number of points in the given section of the level moulding; from each of these points draw a line parallel to bd, and draw $A6'$ perpendicular to bd. Set off the points $1'$, $2'$, $3'$, $4'$, &c. at the same distances respectively from the line $A6'$, as the corresponding points 1, 2, 3, 4, &c. are from the line AB, and through the points $1'$, $2'$, $3'$, &c. draw the moulding. The moulding thus found will mitre with the given one; also, supposing the inclined moulding to be given, the level one may be found in like manner.

If the angle ABC be less than a right angle, the whole process remains the same; but when it is a right angle, BD coincides with bd; and the method of describing the moulding becomes the same as that usually given; as it does not then require the preparatory steps which are necessary when the angle is any other than a right angle.

22. It is in pediments, chiefly, that the method of forming raking mouldings is of use. Fig. 14 represents part of a pediment; AB is that part of the level moulding which mitres with the inclined moulding; all that part of the cornice below B, being continued along the front, the lower members of the raking cornice stop upon it, and, therefore, do not require to be traced from the other. For pediments.

Fig. 14.



In that part of the cornice marked AB, set off a sufficient number of points; and from each of these points draw a line parallel to the rake, or inclination of the pediment. Also, let a verticle line be drawn to each of the same points from the horizontal line rs. Make $s't$ perpendicular to the inclination of the pediment, and with a slip of paper, or by

[1] On this subject the reader may consult Monge's *Géométrie Descriptive*, Art. 19 et 20, par. 23 and 24, 4th edition, Paris, 1820.

means of arcs of circles, transfer the distances on rs to the line $r's$, and from the points thus found, draw lines parallel to st; the intersection of these, with the inclined lines, will determine the form of the moulding, as is indicated by the letters.

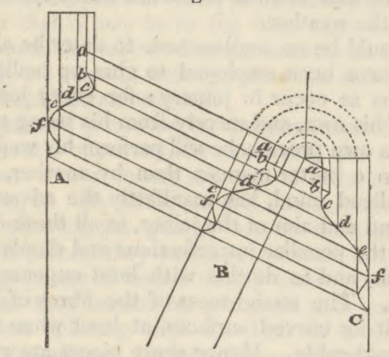
When a pediment has a cornice with modillions, the caps of the modillions require to be traced by the same method.

skirt-

23. It sometimes happens, that an inclined base-moulding has to mitre with a level one at an angle; and as the same thing occurs still more frequently with other moulding, such as cornices under the steps of stairs, &c. we shall give another example, which will serve still farther to illustrate the method of proceeding in such cases.

In fig. 15, a raking base-moulding is shewn, where the

Fig. 15.



inclined moulding B is traced to mitre with the horizontal moulding C; and the horizontal moulding A is traced to mitre with the inclined one B. The preceding examples being understood, the lines and letters in the figure will be sufficient to show the mouldings are traced.

arks ould-

24. Mouldings being almost the only part of modern joiners' work, which can, in strictness, be called ornamental, and consequently that in which the taste of the workman is most apparent, we shall offer a remark or two that may have their use. The form of a moulding should be distinct and varied, forming a bold outline of a succession of curved and flat surfaces, disposed so as to form distinct masses of light and shade. If the mouldings be of considerable length, a greater distinction of parts is necessary than in short ones.

Mouldings for the internal part of a building should not, however, have much projection; the proper degree of shade may always be given, with better effect, by deep sinkings judiciously disposed. The light in a room is not sufficiently strong to relieve mouldings, without resorting to this method; and hence it is that quirked mouldings are so much esteemed.

Sect. II.—On the Construction of Joiners' Work.

lifica- of a er.

25. The goodness of joiners' work depends chiefly upon the care that has been bestowed in joining the materials. In carpentry, framing owes its strength to the form and position of its parts; but in joinery, the strength of a frame depends upon the strength of the joinings. The importance, therefore, of fitting the joints together as accurately as possible, is obvious. It is very desirable, that a joiner should be a quick workman; but it is still more so that he should be a good one; that he should join his materials with firmness and accuracy; that he should make surfaces even and smooth, mouldings true and regular, and the parts intended to move so that they may be used with ease and freedom.

Where dispatch is considered as the chief excellence of a workman, it is not probable that he will strive to improve himself in his art, further than to produce the greatest quantity of barely tolerable work with the least quantity of labour. In some articles of short duration, dispatch in the manufacture may be of greater importance; but in works that ought to remain firm for years, it certainly is bad economy to spare a few shillings' worth of labour at the risk of being annoyed with a piece of bad work as long as it will hold together.

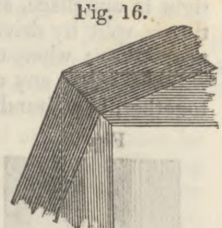
We have seen, with no small degree of pleasure, the effect of encouraging good workmanship in the construction of machinery, and would recommend that a like encouragement should be given to superior workmen in other arts.

Joining Angles.

On joining angles.

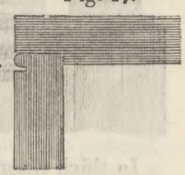
26. When the length of a joint at an angle is not considerable, it is sufficient to cut the joint, so that when the parts are joined, the plane of the joint shall bisect the angle. This kind of joint is shewn for two different angles, by fig. 16.

Fig. 16.



When an angle of considerable length is to be joined, and the kind of work does not require a joining should be concealed, fig. 17 is often employed; the small bead renders the appearance of the joint less objectionable, because any irregularities, from shrinkage, are not seen in the shade of the quirk of the bead.

Fig. 17.



A bead upon an angle, where the nature of the thing does not determine it to be an arris, is attended with many advantages; it is less liable to be injured, and admits of a secure joint, without the appearance of one. Fig. 18 shews

Fig. 18.

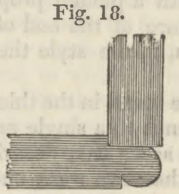


Fig. 19.

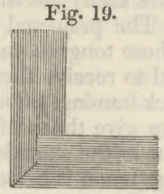
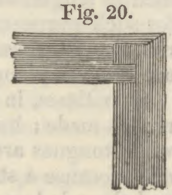


Fig. 20.

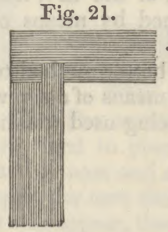


a joint of this description, which should always be used in passages.

Fig. 19 represents a very good joint for an exterior angle, whether it be a long or short one. Such a joint may be nailed both ways. But the joint represented by fig. 20 is superior to it; the parts being drawn together by the form of the joint itself, they can be fitted with more accuracy, and joined with certainty. The angles of pilasters are often joined, as fig. 20.

Interior angles are commonly joined, as shewn by fig. 21.

Fig. 21.



If the upper or lower edge be visible, the joint is mitred, as in fig. 16, at the edge only, the other part of the joint being grooved, as in fig. 21. In this manner are put together the skirting and dado at the interior angles of rooms, the backs, and backlinings of windows, the jambs of door-ways, and various other parts of joiners' work.

Framing.

The object of framing.

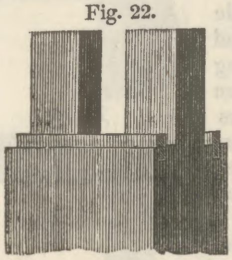
27. Frames in joinery are usually connected by mortise tenon joints, with gooves to receive pannels. Doors, window-shutters, &c. are framed in this manner. The object in framing is, to reduce the wood into narrow pieces, so that the work may not be sensibly affected by its shrink-

age; and, at the same time, it enables us to vary the surface without much labour.

From this view of the subject, the joiner will readily perceive, that neither the parts of the frame nor the pannels should be wide. And as the frame should be composed of narrow pieces, it follows, that the pannels should not be very long, otherwise the frame will want strength. The pannels of framing should not be more than 15 inches wide, and 4 feet long, and pannels so large as this should be avoided as much as possible.[1] The width of the framing is commonly about one-third of the width of the pannel.

It is of the utmost importance, in framing, that the tenons and mortises should be truly made. After a mortise has been made with the mortise chisel, it should be rendered perfectly even with a float; an instrument which differs from a single cut, or float file, only by having larger teeth. An inexperienced workman often makes his work fit too tight in one place, and too easy in another, hence the mortise is split by driving the parts together, and the work is never firm; whereas if the tenon fill the mortise equally, without using any considerable force in driving the work together, is is found to be firm and sound. The thickness of tenons should be about one-fourth of that of the framing, and the width of a tenon should never exceed about five times its thickness, otherwise, in wedging, the tenon will become bent, and bulge out of the sides of the mortise. If the rail be wide, two mortises should be made, with a space of solid wood between; fig. 22 shews the tenons for a wide rail.

Fig. 22.



In thick framing, the strength and firmness of the joint is much increased by putting a cross or feather tongue in on each side of the tenon; these tongues are about an inch in length, and are easily put in with a plough proper for such purposes. The projected figure of the end of a rail, fig. 22, shews these tongues put in, in the style there are grooves ploughed to receive them.

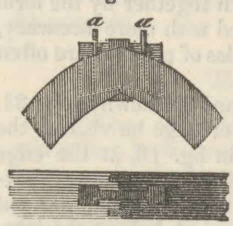
Sometimes, in thick framing, a double tenon in the thickness is made; but we give the preference to a single one, when tongues are put in the shoulders, as we have described; because a strong tenon is better than two weak ones, and there is less difficulty in fitting one than two.

The pannels of framing should be made to fill the grooves, so as not to rattle, and yet to allow the pannels to shrink without splitting.

Joining curved pieces.

28. When a frame consists of curved pieces, they are often joined by means of pieces of hard wood called keys. Fig 23 is the head of a Gothic window frame, joined with a key, with a plan of the joint below it. A cross tongue is put in on each side of the key, and the joint is tightened by means of the wedges *aa*.

Fig. 23.



It is, however, a better method to join such pieces by means of a screw bolt instead of a key, the cross tongues being used whichever method is adopted.

Joining with Glue.

Joining with glue.

29. It is seldom possible to procure boards sufficiently wide for pannels without a joint, on account of heart shakes, which open in drying. In cutting out pannels, for good work, shaken wood should be carefully avoided. That part near the pith is generally the most defective.

If the pannels be thick enough to admit of a cross or feather tongue in the joint, one should always be inserted, for then, if the joint should fail, the surfaces will be kept even, and it will prevent light passing through.

Sometimes plane surfaces of considerable width and length are introduced in joiners' work, as in dado, window backs, &c.; such surfaces are commonly formed of inch, or inch and quarter, boards joined with glue, and a cross or feather tongue ploughed into each joint. When the boards are glued together, and have become dry, tapering pieces of wood, called keys, are grooved in, across the back, with a dovetail groove. These keys preserve the surface straight, and also allow it to shrink and expand with the changes of the weather.

Glueing curved work.

30. It would be an endless task to describe all the methods that have been employed to glue up bodies of such varied forms as occur in joinery; for every joiner forms methods of his own, and merely from his being most familiar with his own process, he will perform his work, according to it, in a better manner than by another, which, to an unprejudiced mind, has manifestly the advantage over it. The end and aim of the joiner, in all these operations, is to avoid the peculiar imperfections and disadvantages of his materials, and to do this with least expense of labour or material. The straightness of the fibres of wood renders it unfit for curved surfaces, at least when the curvature is considerable. Hence short pieces are glued together as nearly in the form desired as can be, and the apparent surface is covered with a thin veneer; or the work is glued up in pieces that are thin enough to bend to the required form. Sometimes a thin piece of wood is bent to the required form upon a cylinder or saddle, and blocks are jointed and glued upon the back; when the whole is completetely dry it will preserve the form that had been given to it by the cylinder.

To determine the thickness of the pieces to glued together.

The proper thickness for the pieces to be bent may be easily determined by an easy experiment on a piece of the same kind of wood. Thus, select a piece of wood, of the same kind as that to be used, and bend it as much as it will bear without injury; then ascertain the radius of curvature, and also the thickness of the piece, at the most curved part of it. From these data the proper thickness for any other curve will be determined by the following proportion:

As the radius of curvature, found by experiment, is to the thickness of the piece tried; so is the radius of any other curve to the thickness of the piece that may be bent into it.[2]

For example, we have found that a piece of straight grained white deal, of an inch in thickness, may be bent, without injury, into a curve of which the radius is 120 inches, therefore, $120 : 1 :: \text{radius} : \text{thickness} = \frac{\text{radius}}{120}$. That is, a piece of deal of the same quality may be bent into any curve, of which the radius is not less than 120 times its thickness.

A piece of work glued up in thicknesses should be very well done; but it too often happens that the joints are visible, irregular, and in some places open; therefore other methods have been tried.

Bending by steam or boiling.

31. If a piece of wood be boiled in water for a certain time, then taken out and immediately bent into any particular form, and it be retained in that form till it be dry, a

[1] Pannels of external doors and shutters may be rendered more secure by boring them, and inserting iron wires. See *Trans. of the Society of Arts*, vol. xxv. p. 106.

[2] The reader will find some interesting propositions relating to fixture in the Article CARPENTRY, p. 624, vol. ii.

permanent change takes place in the mechanical relations of its parts; so that though, when relieved, it will spring back a little, yet it will not return to its natural form.

The same effect may be produced by steaming wood; but though both these methods have been long practised to a considerable extent in the art of ship-building, we are not aware that any general principles have been discovered, either by experiment or otherwise, that will enable us to apply it to an art like joinery, where so much precision is required. We are not aware that it has been tried; but, before it can be rendered extensively useful, the relation between the curvature to which it is bent, and that which it assumes, when relieved, should be determined, and also the degree of curvature which may be given to a piece of a given thickness.

The time that a piece of wood should be boiled, or steamed, in order that it may be in the best state for bending, should be made the subject of experiments; and this being determined, the relation between the time and the bulk of the piece should be ascertained.

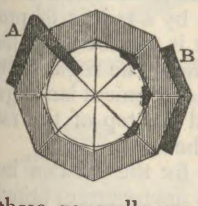
For the joiner's purposes, we imagine, that the process might be greatly improved, by saturating the convex side of each piece with a strong solution of glue, immediately after bending it. By filling, in this manner, the extended pores, and allowing the glue to harden thoroughly before relieving the pieces, they would retain their shape better.

Gl ngup wo n col ns.

32. Large pieces of timber should never be used in joinery, because they cannot be procured sufficiently dry to prevent them splitting with the heat of a warm room. Therefore, the external part of columns, pilasters, and works of a like kind, should be formed of thin pieces of dry wood; and, if support be required, a post, or an iron pillar, may be placed within the exterior column. Thus, to form columns of wood, so that they shall not be liable to split, narrow pieces of wood are used, not exceeding five inches in width. These are jointed like the staves of a cask, and glued together, with short blocks glued along at each joint.

Fig. 24 is a plan of the lower end of a column glued up in staves; the bevel at A is used for forming the staves, that at B is used for adjusting them when they are glued together. A similar plan must be made for the upper end of the column, which will give the width of the upper end of the staves. The bevels taken from the plan, as at A and B, are not the true bevels; but they are those generally used, and are very nearly true, when the columns are not much diminished. To find the true bevels, the principle we have given in art. 19 should be applied. The same method may be adopted for forming large pillars for tables, &c.

Fig. 24.



If a column have flutes, with fillets, the joints should be in the fillets, in order to make the column as strong as possible; also, if a column be intended to have a swell in the middle, proper thickness of wood should be allowed for it.

Sm co- lun , ta- ble rs, &c.

When columns or pillars are small, they may be made of dry wood; and to secure them against splitting, a hole may be bored down the axis of each column.

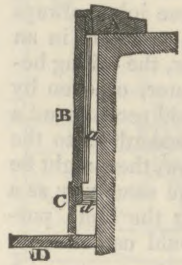
Fixing Joiners' Work.

Fix g wo co- get .

33. We have hitherto confined our remarks to that part of joinery which is performed at the bench; but by far the most important part remains to be considered. For, however well a piece of work may have been prepared, if it be not properly fixed, it cannot fulfil its intended purpose. As in the preceding part, we shall state the general principles that ought to be made the basis of practice, and illustrate those principles by particular examples.

If the part to be fixed consist of boards jointed together, but not framed, it should be fixed so that it may shrink, or swell without splitting. The nature of the work will generally determine how this may be effected. Let us suppose that a plain back of a window is to be fixed. Fig 25 is a section shewing B the back of the window, A the window-sill, D the floor, and C the skirting. The back is supposed to be prepared, as we have stated in art. 29, and that it is kept straight by a dovetailed key *a*. Now, let the back be firmly nailed to the window-sill A, and let a narrow piece *d*, with a groove, and cross tongue, in its upper edge, be fixed to bond timbers or plugs in the wall; the tongue being inserted also into a corresponding groove in the lower edge of the back of B. It is obvious, that the tongue being loose, the back B may contract or expand, as a pannel in a frame. The dado of a room should be fixed in the same manner. In the principal rooms of a house, the skirting C is usually grooved into the floor D, and fixed only to the narrow piece *d*, which is called a ground. By fixing, in this manner, the skirting covers, the joint, which would otherwise soon be open by the shrinking of the back, and from the skirting being grooved into the floor, but not fastened to it, there cannot be an open joint between the skirting and floor. When it is considered, that an open joint, in such a situation, must become a receptacle for dust, and a harbour for insects, the importance of adopting this method of fixing skirting will be apparent.

Fig. 25.



Fixing skirting for rooms.

In fixing any board above five or six inches wide, similar precautions are necessary; otherwise it is certain to split when the house becomes inhabited. We may, in general, either fix one edge, and groove the other, so as to leave it at liberty, or fix it in the middle, and leave both edges at liberty.

Sometimes a wide board, or a piece consisting of several boards, may be fixed by means of buttons, screwed to the back, which turn into grooves in the framing, bearers, or joists, to which it is to be fixed. If any shrinking takes place the buttons slide in the grooves. In this manner the landing of stairs are fixed, and it is much the best mode of fixing the top of a table to its frame.

Fixing landing of stairs, tops of tables, &c.

34. The extension of the principle of ploughing and tonguing work together is one of the most important of the improvements that have been introduced by modern joiners. It is an easy, simple, and effectual method of combination, and one that provides against the greatest defect of timber work, its shrinkage. By means of this method, the bold mouldings of Gothic architecture can be executed with a comparatively small quantity of material; and even in the mouldings of modern architecture it saves much labour. For example, the moulded part of an architrave may be joined with the plain part, as shewn by fig. 26. If this method be compared with the old method of glueing one piece upon another, its advantage will be more evident.

Forming archi- traves, &c.

Fig. 26.

33. The architraves, skirtings, and surbase mouldings, are fixed to pieces of wool called *grounds;* and as the straightness and accuracy of these mouldings must depend upon the care that has been taken to fix the grounds truly; it will appear, that fixing grounds, which is a part often left to inferior workmen, in reality requires much skill and attention; besides, they are almost always the guide for the plasterer. Where the plasterer's work joins the grounds, they should have a small groove ploughed in the edge to form a key for the plaster.

Fixing grounds.

36. In our remarks on construction, we must not omit to say a few words on laying floors, because it will give us

Laying floors.

Joinery.

an opportunity of pointing out a defect which might be easily remedied. The advice of Evelyn, to tack the boards down only the first year, and nail them down for good the next, is certainly the best, when it is convenient to adopt it; but, as this is very seldom the case, we must expect the joints to open more or less. Now these joints always admit a considerable current of cold air, and also, in an upper room, unless there be a counter floor, the ceiling below may be spoiled by spilling a little water, or even by washing the floor. To avoid this, we would recommend a tongue to be ploughed into each joint, according to the old practice. When the boards are narrow, they might be laid without any appearance of nails, in the same way as a dowelled floor is laid, the tongue serving the same purpose as the dowels. In this case we would use cross or feather tongues for the joints.

Folding floors censured.

There is a method sometimes used in laying floors, which workmen call folding; according to this method, two boards are laid, and nailed at such a distance apart, that the space is a little less than the aggregate width of the boards intended for it; these boards are then put to their places, and, on account of the narrowness of the space left for them, they rise like an arch between its abutments. The workmen force them down by jumping upon them. Accordingly, the boards are never soundly fixed to the joists, nor can the floor be laid with any kind of evenness or accuracy. We merely notice this method here, in order that it may be avoided.

Heading joints.

As boards can seldom be got long enough to do without

Fig. 27.

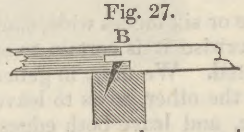
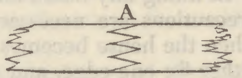


Fig. 28.



joints, it is usual, except in very inferior work, to join the ends with a tongued joint, as shewn in fig. 27, where B is the joist. The etched board is first laid, and nailed to the joist.

In oak floors, the ends are forked together sometimes, as shewn at A, fig. 28, in order to render the joints less conspicuous.

The joints should be kept as distant from one another as possible.

Hinging.

Hinging.

37. It requires a considerable degree of care to hang a door, a shutter, or any other piece of work in the best manner. In the hinge, the pin should be perfectly straight, and truly cylindrical, and the parts accurately fitted together.

The hinges should be placed so that their axes may be in the same straight line, as any defect in this respect will produce a considerable strain upon the hinges every time the hanging part is moved, which prevents it from moving freely, and is injurious to the hinges.

In hanging doors, centres are often used instead of hinges; but, on account of the small quantity of friction in centres, a door moves too easily, or so that a slight draft of air accelerates it so much in falling to, that it shakes the building, and is disagreeable. We have seen this in some degree remedied by placing a small spring to receive the shock of the door.

The greatest difficulty, in hanging doors, is to make them to clear a carpet, and be close at the bottom when shut. To do this, that part of the floor which is under the door, when shut, may be made to rise above a quarter of an inch above the general level of the floor; which, with placing the hinges so as to cause the door to rise as it opens, will be sufficient, unless the carpet should be a very thick one. Several mechanical contrivances have been used for either raising the door, or adding a part to spring close to the floor as the door shuts. The latter is much the better method. The reader who may be desirous of examining this method, may consult the *Transactions of the Society of Arts*, (vol. xxvi. p. 196.)

38. Various kinds of hinges are in use. Sometimes they are concealed, as in the kind of joints called rule joints; others project, and are intended to let a door fold back over projecting mouldings, as in pulpit doors. When hinges project, the weight of the door acts with an increased leverage upon them, and they soon get out of order, unless they be strong and well fixed.

Room doors.

The door of a room should be hung so that, in opening the door, the interior of the room cannot be seen through the joint. This may be done by making the joint according to fig. 29. The bead should be continued round the door, and a common but-hinge answers for it.

The proper bevel for joints of door.

The proper bevel for the edge of a door or sash may be

Fig. 29.

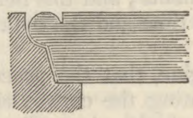
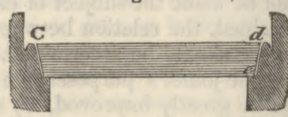


Fig. 30.



found by drawing a line from the centre of motion C, fig. 30, to *e*, the interior angle of the rebate, draw *ed* perpendicular to C*e*, which gives the bevel required. In practice, the bevel is usually made less, leaving an open space in the joint when the door is shut; this is done on account of the interior angle of the rebate often being filled with paint.

Stairs.

Stairs.

39. The construction of stairs is generally considered the highest department of the art of joinery, therefore we treat of it under a distinct head.

The principal object to be attended to in stairs is, that they afford a safe and easy communication between floors of different levels. The strength of a stair ought to be apparent as well as real, in order that those who ascend it may feel conscious of safety. In order to make the communication safe, it should be guarded by a railing of proper height and strength; in order that it may be easy, the rise and width, or tread, of the steps should be regular and justly proportioned to each other, with convenient landings; there should be no winding steps, and the top of the rail should be of a convenient height for the hand.

Proper proportion for stairs.

The first person that attempted to fix the relation between the height and width of a step, upon correct principles, was, we believe, Blondel, in his *Cours d'Architecture.* If a person walking upon a level plane move over a space, P, at each step, and the height which the same person could ascend vertically, with equal ease, were H; then, if h be the height of a step, and p its width; the relation between p and h must be such, that when $p = P$, $h = o$; and when $H = h$, $p = o$. These conditions are satisfied by an equation of the form $h = H\left(1 - \frac{p}{P}\right)$. Blondel assumes 24 inches for the value of P, and 12 inches for that of H; substituting these values in our equation, it becomes $h = \frac{1}{2}(24 - p)$, which is precisely Blondel's rule. We do not think these the true values of P and H; indeed, it would be difficult to ascertain them; but they are so near, and agree so well with our observations on stairs of easy ascent, that they may be taken for the elements of a practical rule. Hence, according as h or p is given, we have

$$h = \frac{1}{2}(24 - p, \text{ or } p = 24 - 2h.$$

Thus, if the height of a step be six inches, then 24 — 12 = 12, the width or tread for a step that rises six inches.

40. The forms of staircases are various. In towns, where

Joinery. Different kinds of stairs.

space cannot be allowed for convenient forms, they are often made triangular, circular, or elliptical, with winding steps, or of a mixed form, with straight sides and circular ends. In large mansions, and in other situations, where convenience and beauty are the chief objects of attention, winding steps are never introduced when it is possible to avoid them. Good stairs, therefore, require less geometrical skill than those of an inferior character.

The best architectural effect is produced by rectangular staircases, with ornamented railing and newels. In Gothic structures scarcely any other kind can be adopted, with propriety, for a principal staircase. Modern architecture admits of greater latitude in this respect; the end of the staircase being sometimes circular, and the hand-rail continued, beginning either from a scroll or a newel.

Rectangular staircases.

41. When a rectangular staircase has a continued rail, it is necessary that it should be curved so as to change gradually from a level to an inclined direction. This curvature is called the *ramp* of the rail. The plan of a staircase of this kind is represented by ABCD, fig. 31, and fig. 32 shews a section of it, supposing it to be cut through at ab, on the plan.

Fig. 31.

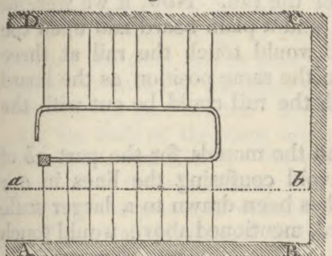
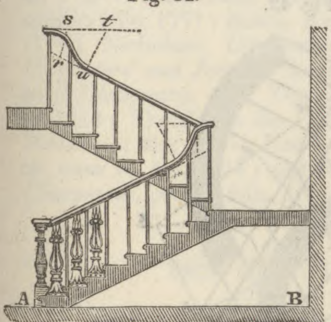


Fig. 32.



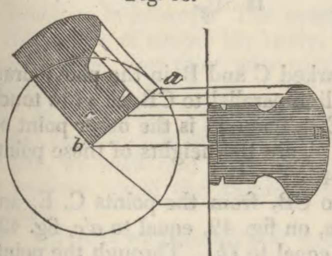
To find the cap of newel.

The hand-rail is supposed to begin with a newel at the bottom, and the form of the cap of the newel ought to be determined, so that it will mitre with the hand-rail. Let H, fig. 33, be the section of the hand-rail, and ab the radius of the newel; then the form of the cap may be traced at C by the method we have already described. (Art. 9 and 10.)

Height for rail, &c.

The sections of hand-rails are of various shapes; some of the most common ones are too small; a hand-rail should never be less than would require a square, of which the side is $2\frac{1}{2}$ inches, to circumscribe it.

Fig. 33.



For the level landings of a staircase the height of the top of the hand-rail should be about 40 inches, and in any part of the inclined rail the height of its upper side above the middle of the width of the step should be 40 inches less the rise of one step, when measured in a vertical direction.

To describe the ramps.

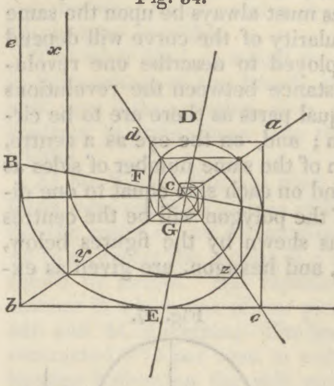
To describe the ramps, let rs be a vertical line drawn through the middle of the width of the step, fig. 32; set ru equal to rs, and draw ut at right angles with the back of the rail, cutting the horizontal line st in t. From the point t, as a centre, describe the curve of the rail. When there is a contrary flexure, as in the case before us, the method of describing the lesser curve is the same.

To draw the logarithmic spiral.

42. The hand-rail of a stair often begins from a scroll; and that kind of spiral which is called the logarithmic spiral, has been proposed as the best for the purpose. It is shewn by writers on curve lines, that any radial lines drawn from the centre will be cut by the logarithmic spiral in one and the same angle. By means of this property of the curve, it may be described as follows:

Let C be the centre, fig. 34, and draw AB perpendicular to DE, crossing it in C. Bisect the angles by the lines ab, cd. Draw eBb to cut CB at the angle proposed for the curve, and to meet Cb in b; draw cb perpendicular to be, cutting Cc in c; draw ca perpendicular to cb cutting Ca in a; and proceed round with as many revolutions as may be required in the same manner. Then B, E, A, D, F, G, &c. are points in the curve, and the lines eb, cb, ca, ad, &c. are tangents to the curves at these points. Therefore, the curve may be either drawn by hand, or by means of circular arcs. Also, any number of interior or exterior spirals may be drawn by drawing lines parallel to the tangents, as xy, yz, &c.

Fig. 34.

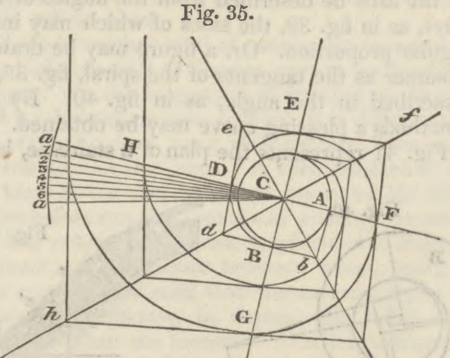


If eb were to cross BC at a right angle, the curve would be a circle.

43. The scrolls and volutes used in architecture are always made to terminate in a circle at the centre; consequently none of the curves described by mathematicians are adapted for these purposes. But the construction we have employed for the logarithmic spiral readily leads to a species of spiral that appears well suited for scrolls or volutes. In the logarithmic spiral the angle of the curve is constant; but imagine the angle to change regularly, and to become a right angle at the point where the circle called the eye begins. This would afford us a regular and pleasing curve, unfolding itself from a circle in the centre. This curve might be called the Architectural Spiral. A new spiral proposed for volutes, scrolls, &c.

Let C be the centre, fig. 35, and round this centre describe a circle for the eye of the scroll, or volute. Divide this circle into eight equal parts, and draw lines from the centre through the points of division.

Fig. 35.



With any radius aC, and C as a centre, describe the arc ac, and upon this arc set off any number of equal divisions. The extent of a division must be regulated by the quantity the curve may unfold at each revolution, and the number depends on the number of revolutions.

Then, beginning at A, draw Ab perpendicular to Ca; db parallel to C′; de perpendicular to C2; ef parallel to C3; and so on for any number of revolutions. The points A, B, D, E, F, G, and H, in the curve, and the tangents to these points, are found; therefore the curve may be described by hand, or by means of circular arcs.

The tangents to any interior or exterior spiral will be parallel to the ones first found, and, therefore, any number may be drawn with the greatest facility.

Joinery.

Neither the logarithmic nor the architectural spiral can be drawn truly by circular arcs; but we shall here point out the principle by which such spirals may be drawn. When a spiral is drawn by means of circular arcs only, the centres of the adjoining arcs must always be upon the same straight line; and the regularity of the curve will depend on the number of arcs employed to describe one revolution. Let the proposed distance between the revolutions be divided into as many equal parts as there are to be circular arcs in one revolution; and, on the eye as a centre, construct a regular polygon of the same number of sides as the number of divisions, and on each side equal to one division. Then the angles of the polygon will be the centres for describing the spiral, as shewn by the figures below, where the triangle, square, and hexagon, are given as examples:

Fig. 36.

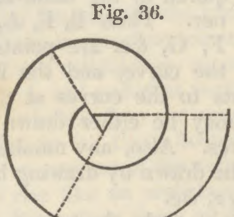


Fig. 37.

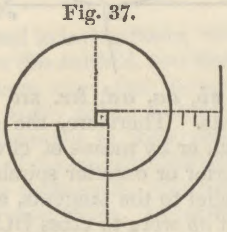


Fig. 38.

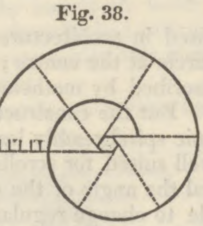
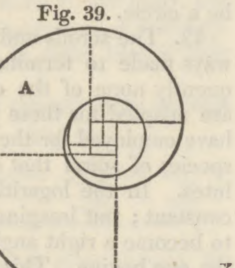


Fig. 39.



If a spiral be drawn to begin from a circle at the centre, let the arcs be described from the angles of a rectangular fret, as in fig. 39, the sides of which may increase in any regular proportion. Or, a figure may be drawn in the same manner as the tangents of the spiral, fig. 35, and the arcs described in the angle, as in fig. 40. By either of these methods a pleasing curve may be obtained.

Staircase with circular ended well-hole.

44. Fig. 41 represents the plan of a staircase, beginning

Fig. 40.

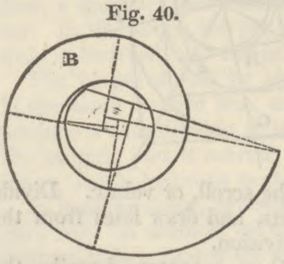


Fig. 43.

Fig. 41.

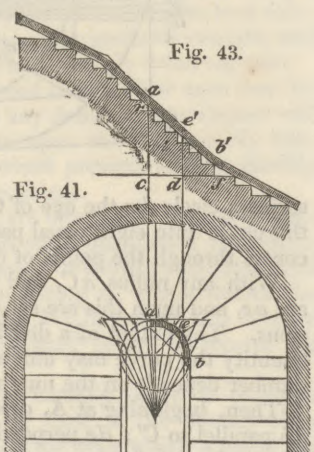
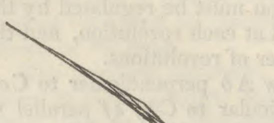


Fig. 44.



with a scroll, and having steps winding round the circular part of the well-hole.

In the first place, let the end of the steps be developed according to the method we have given in Art. 13. Fig. 43 shews this development. Now, the hand-rail ought to follow the inclination of a line drawn to touch the nosings of the steps, except where there is an abrupt transition from the rake of the winding to that of the other steps; at such places it must be curved; the curve may be drawn by the help of intersecting lines, as in fig. 44, if the workman cannot trust to his eye.

Development of circular part.

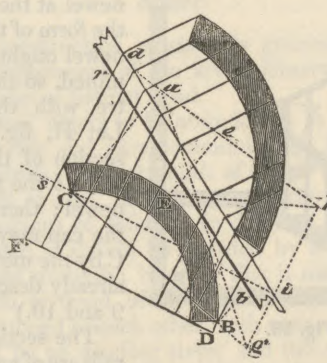
The part which is shaded in fig. 43, represents the hand-rail and ends of the steps, when spread out, and the hand-rail is only drawn close to the steps for convenience, as it would require too much space to raise it to its proper position. This development of the rail is called the falling mould.

The wood used for hand-rails being of an expensive kind, it becomes of some importance to consider how the plank may be cut so as to require the least quantity of material for the curved part of the rail. Now, if we were to suppose the rail executed, and a plain board laid upon the upper side of it, the board would touch the rail at three points; and a plank laid in the same position as the board would be that out of which the rail could be cut with the least waste of material.

To find the face moulds.

Let it be required to find the moulds for the part ab of the rail, fig. 41, and to avoid confusing the lines in our small figure, the part ab has been drawn to a larger scale in fig. 42. The plain board, mentioned above, would touch

Fig. 42.



the rail at the points marked C and B in the plan; draw the line CB, and draw a line parallel to CB, so as to touch the curve at the point E. Then E is the other point on the plan; and a', e', and b', are the heights of these points in the development, fig. 43.

Erect perpendiculars to CB, from the points C, E, and B, fig. 42, and set off Ca, on fig. 42, equal to $a'c$, fig. 43; Ee equal to de', and Bb equal to fb. Through the points C and E, draw the dotted line Ch; through ae draw a line to meet CE in h; and through the points ab, draw a line to meet CB in g; then join hg, and make Ci perpendicular to hg.

Now, if Cd be equal to Ca, and perpendicular to Ci; and di be joined, it will be the angle which the plank makes with the horizontal plane, or plan. Therefore, draw FD parallel to Ci, and find the section by the process described in Art. 10. This section is the same thing as would be obtained by projecting vertical lines from each point in the hand-rail against the surface of a board, laid to touch it in three points. The inexperienced workman will be much assisted in applying the moulds if he acquires a clear notion of the position when executed.

To find the thickness of the plank.

To find the thickness of the plank, take the height to the under side of the rail cr in the development, fig. 43, and set it off from s, in the line Ci, to r, in fig. 42; from the pla-

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the point r draw a line parallel to di, and the distance between those parallel lines will be the thickness of the plank.

The mould, fig. 42, which is traced from the plan, is called the *face mould*. It is applied to the upper surface of the plank, which being marked, a bevel should be set to the angle idC, and this bevel being applied to the edge will give the points to which the mould must be placed to mark out the under side. It is then to be sawn out, and wrought true to the mould. In applying the bevel, care should be taken to let its stock be parallel to the line di, if the plank should not be sufficiently wide for di to be its arris.

After the rail is truly wrought to the face mould, the falling mould, fig. 43, being applied to its convex side, will give the edge of the upper surface, and the surface itself will be formed by squaring from the convex side, holding the stock of the square always so that it would be vertical if the rail were in its proper situation. The lower surface is to be parallel to the upper one.

The sudden change of the width of the ends of the steps causes the soffit line to have a broken or irregular appearance; to avoid it, the steps are made begin to wind before the curved part begins. Different methods of proportioning the ends of the steps are given by Nicholson, Roubo, Rondelet, and Krafft. We cannot in this place enter into a detail of these methods, but for the reader's information a list of the principal writers on staircases is subjoined.

Price, in his *British Carpenter*, 4to, 1735; Langley, *Builders' Complete Assistant*, 8vo, 1738; Frezier, *Coupe des Pierres et des Bois*, 4to, 1739; Roubo, *L'Art du Menuisier*, folio, 1771; Skaife, *Key to Civil Architecture*, 8vo, 1774; Nicholson, *Carpenters' New Guide*, 4to, 1792; *Carpenters' and Joiners' Assistant*, 4to, 1792; *Architectural Dictionary*, 4to; *Transactions Society of Arts*, &c. for 1814; *Treatise on the Construction of Staircases and Handrails*, 4to, 1820; Rondelet, *Traité de l'Art de Bâtir*, tome iv. 4to, 1814; and Krafft, *Traité sur l'Art de la Charpenter*, part ii. folio, 1820.

Sect. III.—On Materials.

45. There is no art in which it is required that the structure and properties of wood should be so thoroughly understood as in joinery. The practical joiner, who has made the nature of timber his study, has always a most decided advantage over those who have neglected this most important part of the art.

In the article Anatomy, Vegetable (vol. iii. p. 61 and 82), the structure of wood is described; in this place, therefore, we shall only show how the joiner may, in a great measure, avoid the warping caused by its irregular texture.

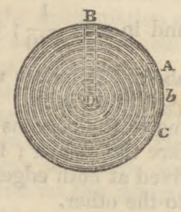
46. It is well known that wood contracts less in proportion, in diameter, than it does in circumference; hence a whole tree always splits in drying. Mr Knight has shown that, in consequence of this irregular contraction, a board may be cut from a tree that can scarcely be made, by any means, to retain the same form and position when subjected to various degrees of heat and moisture. From the ash and the beech he cut some thin boards, in different directions relatively to their transverse septa, so that the septa crossed the middle of some of the boards at right angles, and lay nearly parallel with the surfaces of others. Both kinds were placed in a warm room, under perfectly similar circumstances. Those which had been formed by cutting across the transverse septa, as at A in fig. 44, soon changed their form very considerably, the one side becoming hollow, and the other round; and in drying, they contracted nearly 14 per cent. in width.

Difference in shrinkage.

The other kind, in which the septa were nearly parallel to the surfaces of the boards, as at B in fig. 44, retained, with very little variation, their primary form, and did not contract in drying more than three and a half per cent. in width.[1]

As Mr Knight had not tried resinous woods, two specimens were cut from a piece of Memel timber; and, to render the result of our observation more clear, conceive fig. 45 to represent the section of a tree, the annual rings being shewn by circles. BD represents the manner in which one of our pieces was cut, and AC the other. The board AC contracted 3·75 per cent. in width, and became hollow on the side marked b. The board BD retained its original straightness, and contracted only 0·7 per cent. The difference in the quantity of contraction is still greater than in hard woods.

Fig. 45.



From these experiments, the advantages to be obtained merely by a proper attention in cutting out boards for pannels, &c. will be obvious; and it will also be found that pannels cut so that the septa are nearly parallel to their faces, will appear of a finer and more even grain, and require less labour to make their surfaces even and smooth.

The results of these experiments are not less interesting to cabinet-makers, particularly in the construction of billiard-tables, card-tables, and indeed every kind of table in use. For such purposes, the planks should be cut so as to cross the rings as nearly in the direction BD as possible. We have no doubt that it is the knowledge of this property of wood that renders the billiard-tables of some makers so far superior to those of others.

In wood that has the larger transverse septa, as the oak, for example, boards cut as BD will be figured, while those cut as AC will be plain.

Cause of pieces curving in the direction of their length.

47. There is another kind of contraction in wood whilst drying, which causes it to become curved in the direction of its length. In the long styles of framing we have often observed it; indeed, on this account, it is difficult to prevent the style of a door, hung with centres, from curving, so as to rub against the jamb. A very satisfactory reason for this kind of curving has been given by Mr Knight,[2] which also points out the manner of cutting out wood, so as to be less subject to this defect, which it is most desirable to avoid. The interior layers of wood, being older, are more compact and solid than the exterior layers of the same tree; consequently, in drying, the latter contract more in length than the former. This irregularity of contraction causes the wood to curve in the direction of its length, and it may be avoided by cutting the wood so that the parts of each piece shall be as nearly of the same age as possible.

Changes produced by the weather.

48. Besides the contraction which takes place in drying, wood undergoes a considerable change in bulk with the variations of the atmosphere. In straight-grained woods the change in length is nearly insensible;[3] hence they are sometimes employed for pendulum rods; but the lateral dimensions vary so much, that a wide piece of wood will serve as a rude hygrometer.[4] The extent of variation de-

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[1] *Philosophical Transactions*, part ii. for 1817, or *Philosophical Magazine*, vol. l. p. 437.

[2] *Ibid.*

[3] Mr Ramsden and General Roy made some experiments on the expansion in length. See *Account of the Trig. Survey*, vol i. p. 46 and 49.

[4] See *Phil. Trans.* Lowthorpe's Abridg. vol. ii. p. 37.

Joint || Jolloxochitl.

creases in a few seasons, but it is of some importance to the joiner to be aware, that even in very old wood, when the surface is removed, the extent of variation is nearly the same as in new wood.

It appears, from Rondelet's experiments,[1] that in wood of a mean degree of dryness, the extent of contraction and expansion, produced by the usual changes in the state of the atmosphere, was,

$$\text{in fir wood, from } \frac{1}{360} \text{ to } \frac{1}{75} \text{ part of its width;}$$

$$\text{and, in oak, from } \frac{1}{412} \text{ to } \frac{1}{84} \text{ part of its width.}$$

Consequently, the mean extent of variation in fir is $\frac{1}{124}$, and in oak, $\frac{1}{140}$; and, at this mean rate, in a fir board about $12\frac{1}{2}$ inches wide, the difference in width would be $\frac{1}{10}$th of an inch. This will show the importance of attending to the maxims of construction we have already laid before the reader; for, if a board of that width should be fixed at both edges, it must unavoidably split from one end to the other.

Kinds of wood.

49. The kinds of wood commonly employed in joinery are, the oak, the different species of pine, mahogany, lime-tree, and poplar.

Oak.

Of the oak, there are two species common in this island; that which Linnæus has named *Quercus Robur* is the most valuable for joiners' work; it is of a finer grain, less tough, and not so subject to twist as the other kind. Oak is also imported from the Baltic ports, from Germany, and from America. These foreign kinds being free from knots, of a straighter grain, and less difficult to work, they are used in preference to our home species. Foreign oak is also much used for cabinet-work; and lately, the fine curled oak that is got from excrescences produced by pollard, and other old trees, has been used with success in furniture. When well managed, it is very beautiful, and makes a pleasing variety. It is relieved by inlaid borders of black or white wood, but these should be sparingly used. Borders of inlaid brass, with small black lines, give a rich effect to the darker coloured kinds.

Fir.

The greater part of joiners' work is executed in yellow fir, imported from the north of Europe. White fir is often used for internal work, and American pine is much used for mouldings.

The forest of Braemar, in Aberdeenshire, furnishes yellow fir of an excellent quality, little inferior to the best foreign kinds.

Larch.

For the general purpose of joinery, the wood of the larch tree seems to be the best; this useful tree thrives well on our native hills. We have seen some fine specimens of this wood from Blair-Athol. It makes excellent steps for stairs, floors, framing, and most other articles.

Mahogany.

Mahogany, in joinery, is only used where painted work is improper, as for the hand-rails of stairs, or for the doors and windows of principal rooms. For doors it is not now so often used as it was formerly; its colour is found to be too gloomy to be employed in large masses. In cabinet-work it is almost the only kind used for ornamental work.

Lime-tree. Poplar.

Lime-tree, and the different species of poplar, make very good floors for inferior rooms, and may often be used for other purposes, in places where the carriage of foreign timber would render it more expensive. Lime-tree is valuable for carved work, and does not worm-eat; but carving is at present seldom used in joinery.

For farther information on wood, in addition to the works referred to, the reader may consult Evelyn's *Silva*, Dr Hunter's edition; Duhamel, *Du Transport, de la Conservation, et de la Force des Bois*, Paris, 1767; Barlow's *Essay on the Strength and Stress of Timber*, 1817; Tredgold's *Elementary Principles of Carpentry*, sect. x. 1820; and the article Dry-Rot.[2]

JOINT, in general, denotes the juncture of two or more things. The joints of the human body are called by anatomists *articulations*. See Anatomy.

JOINTURE, in *Scotch Law*, signifies generally a settlement of lands and tenements, made on a woman in consideration of marriage.

JOINVILLE, a city of the department of the Upper Marne, in France, in the arrondissement of Vassy. It stands on the left bank of the Marne, at the foot of a lofty hill, on which there remains an ancient castle, where the association of the League was formed in 1584. It contains 845 houses, and 3100 inhabitants. There are manufactures of woollen cloths and stockings. Long. 5. 1. E. Lat. 48. 26. N.

JOISTS, or Joysts, in *Architecture*, those pieces of timber framed into the girders and summers, upon which the boards of the floor are laid.

JOKAGUR, a town of Hindustan, in the Mahratta territories, in the province of Khandesh, seventy-four miles south-east from Oojain. Long. 76. 46. E. Lat. 22. 31. N.

JOKES. See Jesting.

JOLLOXOCHITL, an Indian word, signifying "flower of the heart," is the name of a plant, bearing a large, beautiful flower, which grows in Mexico, where it is much esteemed for its beauty and odour; the latter being so powerful, that a single flower is sufficient to fill a house with the most pleasing fragrance.

Jonah || Jonathan.

JONAH, or the *Prophecy of Jonah*, a canonical book of the Old Testament, in which it is related, that Jonah, about 771 before Christ, was ordered to go and prophecy the destruction of Nineveh, on account of the wickedness of its inhabitants. But the prophet, instead of obeying the divine command, embarked for Tarshish, when, a tempest arising, the mariners threw him into the sea. He was swallowed by a great fish, and after being three days and nights in its belly, was cast upon the land. The prophet, sensible of his past danger and surprising deliverance, now betook himself to the journey and embassy to which he was appointed; and arriving at Nineveh, the metropolis of Assyria, he, according to his commission, boldly laid open the sins of the Ninevites, and proclaimed their sudden overthrow; upon which the whole city, by prayer, fasting, and speedy repentance, happily averted the divine vengeance, and escaped the threatened ruin. Upon this, Jonah, fearing that he would pass for a false prophet, retired to a hill at some distance from the city, where God, by a miracle, condescended to show him the unreasonableness of his discontent.

JONATHAN, the son of Saul, celebrated in sacred history for his valour, and his friendship for David against

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[1] *Traité Théoretique et Pratique de l'Art de Bâtir*, article Menuiserie, tome iv. p. 425, 1814.

[2] When the roof of Westminster Hall was under repair, an opportunity was taken to examine the wood of which it is constructed; and it was found to be of oak, and not of chestnut, as stated in the Article Dry-Rot, vol. viii. p. 233. The oak has been of an excellent kind, but is now much worm-eaten.

Jonathan ‖ Jones, Inigo.

the interest of his own house. He was slain in battle in the year 1055 before Christ.

JONATHAN, or *Jonas, Maccabæus*, brother of Judas, a renowned general of the Jews. He forced Bacchides, the Syrian general, who made war with the Jews, to accept a peace, conquered Demetrius Soter, and afterwards defeated Apollonius, general of that prince; but, being ensnared by Tryphon, he was put to death, 144 before Christ.

JONES, Inigo, a celebrated English architect, the son of a cloth-worker of London, was born in 1572. He was at first put as apprentice to a joiner; but having early distinguished himself by his inclination for drawing or designing, he was particularly noticed for his skill in landscape-painting. This afterwards recommended him to the favour of William earl of Pembroke, who sent him abroad with a handsome allowance, in order to perfect himself in that branch. He had no sooner arrived at Rome, than he found himself in his proper sphere; he felt that nature had not formed him to decorate cabinets, but to design palaces. He accordingly dropped the pencil, and conceived Whitehall. In the state of Venice he saw the works of Palladio, and learned that refined taste may be exerted on a less theatre than the capital of an empire. How he distinguished himself in a place where he had no opportunity to display his talents, we are not informed, though it would not be the least curious part of his history. Certain it is, however, that, on the strength of his reputation at Venice, Christian IV. invited him to Denmark, and appointed him his architect; but on what buildings he was employed in that country we have yet to learn. James I. found him at Copenhagen, and Queen Anne took him, in the capacity of her architect, to Scotland. He served Prince Henry in the same capacity, and the place of surveyor-general of the works was granted to him in reversion. On the death of that prince, Jones travelled once more into Italy, and, assisted by maturity of judgment, perfected his taste. To the interval between these voyages Mr Walpole is inclined to attribute those buildings of Jones which are less pure, and border too much upon the bastard style. Inigo's designs of that period are not Gothic, but have a littleness of parts, and a weight of ornament, with which the revival of the Grecian taste was encumbered, and which he shook off in his grander designs. The surveyor's place having become vacant, he returned to England; and, as if architecture was not all he had learned at Rome, he disinterestedly gave up the profits of his office, which he found extremely in debt, and prevailed upon the comptroller and paymaster to imitate his example, until the whole arrears were cleared off.

In 1620 he was employed in a manner very unworthy of his genius, King James having set him upon discovering, or rather guessing, who were the founders of Stonehenge. But his ideas were all Roman; consequently, his partiality to his favourite people, which ought rather to have prevented him from charging them with that mass of barbarous clumsiness, made him conclude that it was a Roman temple.

In the same year Jones was appointed one of the commissioners for the repair of St Paul's; but this was not commenced till the year 1633, when Laud, then bishop of London, laid the first stone, and Inigo the fourth. In the restoration of that cathedral he made two capital faults. He first renewed the sides with very bad Gothic; and then added a Roman portico, magnificent indeed, but which had no affinity to the ancient parts that remained, and made his own Gothic appear ten times heavier. He committed the same error at Winchester, thrusting a screen in the Roman or Grecian taste into the middle of that cathedral. Jones indeed was by no means successful when he attempted Gothic. The chapel of Lincoln's-Inn has none of the characteristics of that architecture. The cloister beneath seems oppressed by the weight of the building above.

The authors of the life of Jones place the erection of the Banqueting House in the reign of King Charles; but it appears, from the accounts of Nicholas Stone, that it was begun in 1619, and finished in two years, being a small part of the pile designed for the palace of our kings, but so complete in itself, that it stands as a model of its kind. Several plates of the intended palace at Whitehall have been given, but, Mr Walpole thinks, from no finished design. The four great sheets are evidently made up from general hints; nor could such a source of invention and taste as the mind of Inigo ever produce so much sameness. The whole fabric, however, was so great an idea, that, according to Walpole, one forgets for a moment, in the regret for its not being executed, the confirmation of our liberties, obtained by a melancholy scene that passed before the windows of that very Banqueting House.

In 1623 he was employed at Somerset House, where a chapel was to be fitted up for the Infanta, the intended bride of the prince. The chapel is still in existence. The front to the river, part only of what was designed, and the water-gate, were afterwards erected on the designs of Inigo, as was the gate at York Stairs.

On the accession of Charles, Jones was continued in his posts under both king and queen. His fee as surveyor was eight shillings and fourpence a day, with an allowance of L.46 a year for house-rent, besides a clerk, and incidental expenses. What other remuneration he received, or whether he received any at all, we have not been informed.

During the prosperous state of the king's affairs, the pleasures of the court were indulged in with much taste and magnificence. Poetry, painting, music, and architecture, were all called in to contribute rational amusements. Mr Walpole is of opinion, indeed, that the celebrated festivals of Louis XIV. were copied from the shows exhibited at Whitehall, in his time the most polite court in Europe. Ben Jonson was the laureate; Inigo Jones the inventor of the decorations; Laniere and Ferabosco composed the symphonies; whilst the king, the queen, and the young nobility, danced in the interludes. We have accounts of many of those entertainments called "masques," which had been introduced by Anne of Denmark. Lord Burlington had a folio of the designs for these solemnities, by Inigo's own hand, consisting of habits, masks, scenes, and so forth. The harmony of these masks was a little interrupted by a war which broke out between the composers, Inigo and Ben, in which, whoever was the aggressor, the turbulent temper of Jonson took care to put him most in the wrong.

The works of Inigo Jones are not scarce; and Surgeons' Hall is one of his best performances. One of the most admired is the arcade of Covent-garden, and the church; "two structures," says Mr Walpole, "of which I want taste to see the beauties. In the arcade there is nothing remarkable; the pilasters are as arrant and homely stripes as any plasterer could make. The barn-roof over the portico of the church strikes my eyes with as little idea of dignity and beauty as it could do if it covered nothing but a barn. It must be owned, that the defect is not in the architect, but in the order. Who ever saw a beautiful Tuscan building? Would the Romans have chosen that order for a temple?" The expense of building the church amounted to L.4500.

Ambresbury in Wiltshire was designed by Jones, but executed by his scholar Webb. Jones was one of the first who observed the same diminution in pilasters as in pillars. Lindsay House in Lincoln's-Inn Fields, which he built, owes its chief grace to this singularity. In 1618, a special commission was issued to the Lord Chancellor, the Earls of Worcester, Pembroke, Arundel, and others, to plant and reduce to uniformity Lincoln's-Inn Fields, as it should be drawn by way of map or ground-plot, by Inigo Jones, surveyor-general of the works. That square is laid out with a regard to so trifling a singularity, as to be of the exact dimensions of one of the Pyramids; a conceit which would have been admired in those ages when the keep at Kenilworth Castle was erected in the form of an horse-fetter, and the Escurial in the shape of St Laurence's gridiron.

Coleshill in Berkshire, the seat of Sir Matthew Pleydell, built in 1650, and Cobham Hall in Kent, were works of Jones. He was employed to rebuild Castle Ashby, and finished one front; but the civil war interrupted his progress there and at Stoke Park in Northamptonshire. Shaftesbury House, now the London Lying-in Hospital, on the east side of Aldersgate Street, is a beautiful front of his. The Grange, the seat of Lord Henley, in Hampshire, is entirely of this master. It is by no means a large house, but one of the best proofs of his taste. The hall, which opens to a small vestibule with a cupola, and the staircase adjoining, are beautiful models of the purest and most classic antiquity The gate of Beaufort Garden at Chelsea, designed by Jones, was purchased by Lord Burlington, and transported to Chiswick. He also drew a plan for a palace at Newmarket. One of the most beautiful of his works is the queen's house at Greenwich. The first idea of the hospital is said to have been taken from his papers by his scholar Webb. Heriot's Hospital in Edinburgh, and the improvements made in his time on Glammis Castle, Forfarshire, Scotland, are specimens of the designs of Inigo Jones.

Inigo tasted early the misfortunes of his master. Being not only a favourite, but a Roman Catholic, he in 1646 paid L.545 for his delinquency and sequestration. Whether it was before or after this fine, it is uncertain, that he and Stone the mason buried their joint stock in Scotland yard; but an order being published to encourage the informers of such concealments, and four persons being privy to the spot where the money was hidden, it was taken up, and reburied in Lambeth marsh. Grief, misfortunes, and age, put a period to his life, at Somerset House, on the 21st of July 1651. Several of his designs have been published by Mr Kent, Mr Colin Campbell, and Mr Isaac Ware. He left in manuscript some curious notes on Palladio's architecture, which are inserted in an edition of Palladio published in 1714.

Jones, *Sir William*, the son of William Jones, Esq. an eminent mathematician, contemporary with the great Newton, was born in London on the 28th of September 1746, and received the rudiments of his education at Harrow School, under the tuition of Dr Robert Sumner, whom he has celebrated in an elegant and affecting enlogium. From Harrow School he went to University College, Oxford, where the rapidity of his literary acquisitions excited universal admiration.

He travelled through France at the age of twenty-three, taking up his residence for some time at Nice, where society, and the various forms of government, became the favourite objects of his investigation. A wish to relieve his mother from the burden of his education made him long for a fellowship in his college; but having no immediate prospect of obtaining it, he, in 1765, became tutor to young Lord Althorp, afterwards Earl Spencer, in which situation he was introduced to the best of company, and had also leisure to prosecute the acquisition of knowledge, and the further cultivation of his intellectual powers, which were objects ever dear to him.

He obtained next year the fellowship he expected, and was thus raised to a state which he could not help viewing as independent. Being at Spa with his pupil in the year 1767, he employed much of his time in making himself acquainted with the German language; and in the following year he was requested, by the Duke of Grafton's under-secretary, to undertake a translation of a Persian manuscript of the life of Nadir Shah into the French language, of which the king of Denmark was anxious to have a version. This, his first publication, appeared in 1770, with the addition of a treatise on oriental poetry, which was very much admired on account of the elegance of the French style and the accuracy of the translation. For this excellent publication it appears that he received nothing more than a diploma from his Danish majesty, constituting him a member of the Royal Society of Copenhagen, with a warm recommendation to the notice of his own sovereign.

That he might be enabled to gratify his commendable ambition, he now began to think seriously of some profession; and, as he had conceived an early predilection for the law, he made that the object of his choice, and, in the month of September 1770, entered himself at the Temple. Yet the studies of his profession did not prevent him from making those literary advances in which he so much delighted; and oriental literature still continued a favourite object. When the life of Zoroaster by Anquetil Duperron made its appearance, in the preliminary discourse to which the university of Oxford had been attacked, our author defended it in a pamphlet written with equal severity and elegance. In 1772, he published a small volume of poems, being translations from the Asiatic poets, remarkable for the grace and brilliancy of their style; and in 1774 appeared his work *De Poesi Asiatica*, the beauty and purity of the Latin in which it is composed exciting the admiration of men of taste and learning both at home and abroad. He was called to the bar in the beginning of 1774, but declined to act in that capacity without a previous knowledge of the actual business of the profession. He was appointed a commissioner of bankrupts in 1776, about which period he addressed a letter to Lord Althorp, in which he expresses his ardent wish to have constitutional liberty established by constitutional means.

His translation of the speech of Isæus, on account of the elegant style and the profound critical and historical knowledge it displayed, commanded the admiration of every competent judge. Soon after this his practice at the bar increased with rapidity; but he had little reason to flatter himself with the prospect of advancement in professional rank and dignity, because he was known to be convinced of the injustice of the British cause respecting the American war, which he was at no pains to conceal; and an opponent of the measures of those who had then the direction of public affairs, had little preferment to look for. In 1780 he became a candidate to succeed to Sir Roger Newdigate as representative in parliament for the university of Oxford, in which he was respectably supported; but his political sentiments were ill suited to secure him a majority, a circumstance which made him decline the contest prior to the election. He soon afterwards published a pamphlet entitled "An Inquiry into the legal mode of suppressing Riots, with a Constitutional Plan of future Defence," recommending the propriety of making every citizen a soldier in cases of imminent danger. He next published a translation of seven ancient poems of the highest reputation in Arabia, which, with an ode on the marriage of Lord Althorp, procured for him the highest reputation. His essay on the law of bailment was also much admired, as was his speech at the London Tavern in defence of a parliamentary reform in 1782. At Paris he drew up a dialogue between a farmer and a country gentleman on the principles of government, which was published in Wales by the dean of St Asaph, and for which a bill of indictment was preferred against that clergyman. In a letter to Lord Kenyon, Mr Jones avowed himself the author, and asserted the principles it contained to be perfectly agreeable to the British constitution; but it appears that he afterwards relaxed considerably in his political ardour.

After the resignation of Lord North, and the appointment of Lord Shelburne, Mr Jones was nominated one of the judges in the British territories of India; an appointment which he had long wished for, as it would afford him an opportunity of prosecuting his favourite researches into oriental literature. He was appointed a judge in March 1783, and on the 20th of that month the honour of knighthood was conferred upon him. He arrived at Calcutta in September, and entered upon his office in December, opening the sessions with a very elegant charge to the grand jury. Here he planned the institution of a society similar to the Royal Society of London, the valuable labours and researches of which are already in the hands of the public. He collected materials for a complete digest of the Hindu and Mahommedan laws, which interesting work he did not live to bring to a conclusion. The publication of the *Asiatic Researches* occupied much of his attention. In 1789 he translated an ancient Indian drama called *Sacontala*, which has been considered as an interesting curiosity. In 1794 he gave the world his Ordinances of Menu, a famous Indian legislator, containing a system of duties both civil and religious.

The climate of India having proved unfavourable to the health of Lady Jones, she was obliged to return to England, whither Sir William designed soon to follow her. But, on the 20th of April 1794, he was seized at Calcutta with an inflammation of the liver, which set the powers of medicine at defiance, and on the 27th of the same month he expired without pain or struggle.

It may be fairly asserted that few men have died more respected or regretted, as few have passed a more useful and irreproachable life. The uncommon extent of his erudition has been displayed in all his writings, and hardly any subject of human research escaped his notice. He has scarcely ever been equalled as a linguist, for he is said to have been more or less acquainted with about twenty-eight different languages. Taste and elegance marked all his exertions, and he might have risen as a poet to the very first rank. Great as his knowledge was, his virtue and religion were not inferior. In whatever light we think proper to view him as standing in relation to society, he was undoubtedly a pattern worthy of imitation.

As a permanent monument to his memory, his affectionate lady published his whole finished works in six quarto volumes, in the year 1799; and a marble monument to his memory by the same endeared friend was placed in the anti-chamber of University College, Oxford. The East India Company also voted a monument to his memory in St Paul's Cathedral, and a statue of him to be sent out to Bengal. Memoirs of his life were published by Lord Teignmouth; and a society of gentlemen in Bengal, who had been educated at Oxford, subscribed a sum for a prize dissertation on his character and merits, by students of that university.

JONK, Jonque, or Junk, in naval affairs, is a kind of small ship, very common in the East Indies. These vessels are of various dimensions; and differ in the form of their building, according to the different methods of naval architecture used by the nations to which they belong. Their sails are frequently made of mats, and their anchors of wood.

JONKOPING, a province in the south of Sweden, extending over 4804 square miles, and situated between 56. 56. and 58. 9. of north latitude, and 13. 9. and 15. 36. of east longitude. It is a mountainous and rocky district; but in the cultivated parts produces corn sufficient for food, and tolerable crops of potatoes, hemp, flax, and buck-wheat. The mines produce a little gold and silver, and considerable portions of iron and copper. The woods are extensive, and furnish deals, pitch, tar, and potash for exportation. It is divided into six bailiwicks or circles, comprehending three towns or cities, 4029 farming or mining establishments, and 121,250 inhabitants, who are remarkable for their sprightly cheerfulness, and especially for their activity. Jonkoping, the capital of the province, is a city on the Lake of Wetter, and close to two smaller lakes. It is well and regularly built, the court of justice and guildhall being of stone. It contains three churches, 608 houses, and 3145 inhabitants. A detachment of artillery is fixed here, with its laboratory and stores.

JONSAC, an arrondissement of the department of the Vendee, in France, extending over 622 square miles. It is divided into seven cantons, and these into 120 communes, and contains 78,528 inhabitants. The capital, a city of the same name, stands on the river Seugne, and has 610 houses, with 2590 inhabitants, whose chief trade is in wine and brandy.

JOORIA, a populous and thriving sea-port of Hindustan, in the Gujerat peninsula, belonging to the rajah of Amram. It is situated on the Gulf of Cutch, twenty miles below Wowamia, and carries on a considerable traffic with Mandavee and other places in the Gulf of Cutch, and on the western coasts of India, Persia, and Arabia, and occasionally with Bombay. Its exports consist chiefly of cotton, ghee, oil, and hides, to the southward, and coarse cloth for Persia and Arabia. In return it receives spices of all sorts, powder, lead, and cocoa-nuts. In 1808, the rajah and principal inhabitants agreed with the Bombay government not to permit or connive at piracy; and also to abstain from plundering persons in distress. Long. 70. 40. E. Lat. 22. 40. N.

JOR, the Hebrew for a river, which, joined with Dan, concurs to form the term *Jordan*.

JORDAN, a celebrated river of Palestine, which has its rise in a mountain called Jebel Sheik, and passing by Cæsarea Philippi, now called Panias, is increased by other tributary streams from the adjacent mountains, when it becomes a considerable river. It rolls on for ten miles through rocky and wooded banks, when it enters the great Lake of Tiberias on the north side, and again issues from its southern extremity. It then meanders in a southern direction through an extensive plain, and passing to the east of Jericho, falls into the Dead Sea, or Lake Asphaltites. The lower part of its course is through the middle of a barren valley, with hills of white clayey soil on each side, about 200 feet in height. Its banks, when it was crossed by Mr Buckingham, and when it was at its lowest ebb, were fourteen or fifteen feet high. On each side the stream is lined by close thickets, which would afford ample shelter to wild beasts; and which, being driven away by the swelling of the river, has given rise to the Scripture expression, like "a lion from the swelling of Jordan." Near Jericho the Jordan is deep and very rapid, nearly equal in breadth to the Thames at Windsor. It overflows its banks both in the spring and during the time of harvest, from the early and the later rains.

JORDANO, Lucca, an eminent Italian painter, was born at Naples in the year 1632. He became early a disciple of Ribera; but going afterwards to Rome, he attached himself to the manner of Pietro da Cortona, whom he assisted in his great works. Some of his pictures being seen by Charles II. king of Spain, he engaged him to paint the Escurial, in which task he acquitted himself as a great painter. The king having shown him a picture of Bassani, expressing his concern that he had not a companion, Lucca painted one so exactly in Bassani's manner, that it was considered as a performance of that master; and for this service he was knighted, and gratified with several honourable and valuable employments. The works he had executed in

Spain raised his reputation so high when he returned to Naples, that, though he was a very quick workman, he could not supply the eager demands of the citizens. No one, not even Tintoret, ever painted so much as Jordano; and his generosity carried him so far as to present altar-pieces to churches that were not able to purchase them. His labours were rewarded with great riches, which he left to his family at his death, which took place in 1705.

JORJAN, a town of Persia, in the province of Astrabad, situated to the east of the Caspian. It is considered as one of the strongest fortresses in the kingdom, and is frequently mentioned in Persian history. It is 100 miles west of Meshid, and 300 north-north-east of Ispahan.

JOSEPH, the son of Jacob, memorable for his chastity, and the honours conferred on him at the court of Egypt. He died in the year 1635 before Christ, aged a hundred and ten.

JOSEPHUS, the celebrated historian of the Jews, was of noble birth, being by his father Mattathias descended from the high priests, and by his mother of the blood-royal of the Maccabees. He was born A. D. 37, under Caligula, and lived under Domitian. At sixteen years of age he betook himself to the sect of the Essenes, and then to the Pharisees; and having been successful in a journey to Rome, upon his return to Judæa he was made captain-general of the Galileans. Being taken prisoner by Vespasian, he foretold his coming to the empire, and his own deliverance by his means. He accompanied Titus to the siege of Jerusalem, and wrote his Wars of the Jews, which Titus ordered to be put in the public library. He afterwards lived at Rome, where he enjoyed the privileges of a Roman citizen, and where the emperors loaded him with favours, and granted him large pensions. Besides the above work, he wrote, 1. Twenty books of Jewish Antiquities, which he finished under Domitian; 2. Two books against Apion; 3. A Discourse on the Martyrdom of the Maccabees; and, 4. His own Life. These works are all written in Greek.

JOSHUA, the renowned general of the Jews, who conducted them through the wilderness, and died in 1424 before Christ, aged a hundred and ten years.

JOSHUA, a canonical book of the Old Testament, containing a history of the wars and transactions of the person whose name it bears. This book may be divided into three parts; the first of which is a history of the conquest of the land of Canaan; the second, which begins at the twelfth chapter, is a description of that country, and the division of it amongst the tribes; and the third, comprised in the two last chapters, contains the renewal of the covenant which he caused to be made by the Israelites, together with the death of their victorious leader and governor. The whole comprehends a term of seventeen, or, according to others, of twenty-seven years.

JOSIAH, king of Judah, the destroyer of idolatry, and the restorer of the true worship, an excellent magistrate and a valiant general, was slain in battle, 609 before Christ.

JOSSELIN, a town of the arrondissement of Ploermel, in the department of Finisterre, in France. It stands on the river Oust, contains 2692 inhabitants, and has some manufactures of coarse woollen cloths. It is visited in summer on account of celebrated mineral springs. Near to it is a curious cavern called the Pertuis des Fées, or Fairy's Cave, with an arch twenty-five feet in height.

JOTAPATA, in *Ancient Geography*, a town of the Lower Galilee, distant forty stadia from Gabara; a strong place, situated on a rock, walled round, and encompassed on all hands with mountains, so as not to be seen except by those who approach very near. It was taken with difficulty by Vespasian. When it surrendered, it was ordered to be razed.

JOUDPOOR, an extensive rajpoot principality of Hindustan, in the province of Ajmeer, of which the proper and ancient name was Marwar, and its sovereign was called the Rhatore rajah. The boundaries of this territory are not very exactly defined, being intermixed with that of Odeypoor and Jyepoor. They are said, however, to reach nearly to the Indus on the west, the town of Amerkote in Sinde, within thirty miles of that river, being in possession of the rajah; on the east his territories comprehend the city of Meerta or Meerat: on the north they are bounded by Bicanere and Jesselmere; on the south by the province of Gujerat and Odeypoor; and on the east by the dominions of Jyenagur. The southern and eastern parts of Joudpoor are fertile, being watered by streams that flow from the mountains. They are chiefly cultivated by Jauts, and they produce wheat, barley, and other kinds of grain common in India; also cotton, sugar, &c. The western portion of the country consists principally of desert or pasture lands, on which is bred a hardy race of horses, camels, and cattle. There are also lead mines in the country. The imports consist of cloth, shawls, spices, opium, rice, sugar, steel, and iron. The exports are salt, camels, bullocks, and horses. The principal inhabitants of Joudpoor are Rhatore rajpoots, who are a brave, handsome race of men, of the purest castes. The rajahs of Odeypoor, Jyepoor, and Joudpoor formerly enjoyed considerable power and consequence, and their alliance was much sought after by the Mogul emperors of Hindustan. The country is described as having been much more populous in ancient times.

The rajahs of Jyepoor and Joudpoor were employed with their followers in the imperial armies, and attained the highest military rank till the time of Aurungzebe, who attempted to enforce the capitation tax on his Hindu subjects, and sought to obtain possession of the children of the rajah Jerwont Sing, who died in the year 1678; a circumstance that gave rise to a war, in which the rajpoots were ultimately victorious, and, after the death of Aurungzebe, they only paid a nominal allegiance. Being afterwards weakened by dissensions amongst themselves, they became tributary to the Mahrattas, and were only delivered from their yoke by the British in their successful war against the Pindaries.

JOUDPOOR, a fortified city, and capital of the above principality, is well built, mostly of stone. It is situated on a hill; and carries on a considerable traffic, by means of caravans, with Gujerat and the Deccan. The rajah is now one of the British allies. Long. 73. 18. E. Lat. 26. 27. N.

JOURNAL, a day-book, register, or account of what passes daily. See DIARY.

JOURNAL, in merchants' accounts, is a book in which every particular article is posted out of the waste-book, and made debtor. This is to be very clearly worded, and fairly engrossed. See BOOK-KEEPING.

JOURNAL, in *Navigation*, a sort of diary or daily register of the ship's course, winds, and weather, together with a general account of whatever is material to be remarked in the period of a sea-voyage. In all such journals, the day, or what is called the twenty-four hours, terminate at noon, because the errors of the dead reckoning are at that period generally corrected by a solar observation. The daily compact usually contains the state of the weather; the variation, increase, or diminution of the wind; and the suitable shifting, reducing, or enlarging the quantity of sail extended; as also the most material incidents of the voyage, and the condition of the ship and her crew; together with the discovery of other ships or fleets, land, shoals, breakers, soundings, and the like.

JOURNAL is also a common name of weekly essays, newspapers, and also of several books which come out at stated times, and give abstracts, accounts, or criticisms of the new books that are published, and the improvements daily made in arts and sciences.

JOURNEY, a tract of ground passed over in travelling by land, properly as much as may be passed in one day.

JOURNEYMAN, properly one who works by the day only; but the word is now used for any one who works under a master, either by the day, the year, or the piece.

JOVIAN, the Roman emperor, elected by the army after the death of Julian the Apostate, in 363. He at first refused to assume the purple, saying he would not command idolatrous soldiers; but, upon an assurance that they would embrace Christianity, he accepted the throne, and immediately shut all the pagan temples. But he did not long enjoy the dignity to which his merit had raised him, having been suffocated in his bed by the fumes of a fire which had been made to dry the chamber. This happened A. D. 364, in the thirty-third year of his age, and the eighth month of his reign. See CONSTANTINOPLE.

JOVIUS, PAUL, in Italian *Giovio*, a celebrated historian, was born at Como, in Italy, in the year 1483. As his father died in his infancy, he was educated by his eldest brother Benedict Jovius, under whom he became well skilled in classical learning; and then went to Rome for the sake of enjoying the benefit of the Vatican library. He there wrote his first work, *De Piscibus Romanis*, which he dedicated to Cardinal Louis of Bourbon. For many years he received a pension of five hundred crowns from Francis I. king of France, whose favour he secured by his flatteries. But, in the following reign, having disgusted the Constable Montmorency, his name was struck out of the list of pensioners. Jovius, however, did not suffer his spirits to sink under his misfortune. He had obtained a high reputation in the learned world by his writings; and having always showed great respect to the house of Medicis, on whose praises he had expatiated in his works, he applied to Clement VII. and obtained the bishoprick of Nocera. His principal production is his History, which is that of his own time, beginning with 1494, and extending to the year 1544. The composition of this work constituted the chief business of his life. For he formed the plan of it in the year 1515, and continued to labour upon it till his death, which happened at Florence in 1552. It is printed in three volumes folio. Jovius is allowed to have been a man of wit as well as learning; he was master of a polished style, and has made many curious observations; but being a venal writer, his statements are not much credited.

JOY, in *Ethics*, is that passion which is produced by love, regarding its object as present, either immediately or in prospect, in reality or imagination. The operation of joy sometimes affects the functions of the body, by increasing the secretion of perspiration, and otherwise.

JUAN FERNANDEZ, an island in the South Pacific Ocean, about one hundred and ten leagues west of Chili, of which it may be considered an appendage, the governor of it being appointed by the president of that republic. It is about twelve miles in length, and hardly six in breadth; but, though small, it is so diversified by lofty hills, streams, and varied vegetation, that it has been described as one of the most enchanting spots upon the sea. It abounds with excellent timber trees, amongst which are the sandal, the yellow wood, and the chonta, a species of palm, which produces a pleasant fruit. It is noted for the refreshments it has afforded to navigators, from its wild goats, vegetables, and water. This island was discovered by Juan Fernandez, from whom it derived its name, and was early settled from the continent of South America. After the death of the discoverer it was deserted, but subsequently the Spaniards made a permanent establishment on it, and settled the port called Juan Fernandez on the south-west coast. There is another port lying to the south, which is called English Harbour, from the circumstance of its having given shelter to Anson's squadron during his celebrated voyage round the world. It was also early noted for having been the solitary residence for several years of Alexander Selkirk, a Scotch mariner, who was cast away upon it; an event upon which, as is well known, De Foe founded his celebrated narrative of Robinson Crusoe. Long. 78. 58. 15. W. Lat. 33. 40. 0. S.

JUAN *de Ulloa*, or the island of Sacrifices, is an island on the west coast of Mexico, in the bay of Vera Cruz. It was first visited by Grijalva, who gave it its name from having found on it a temple in which a human sacrifice had been offered up the day previous to his landing. It is now a mere heap of sand, but there are vestiges of ruins upon it; and when Humboldt was in this quarter of the world, one wretched Indian family constituted its only inhabitants.

JUAN *Blanco*, or *White Jack*, a Spanish name for platina.

JUBA, king of Numidia, who succeeded to the throne on the death of his brother Hiempsal, about B. C. 50. In the war between Cæsar and Pompey, we find Juba espousing the cause of the latter, and proceeding to the assistance of Varus, who was besieged in Utica by Curio. He gained a victory over Curio; and when many of the partisans of Cæsar had surrendered to Varus, on condition of their lives being preserved, Juba, disregarding the promise made to them, put the greater part to death. (Cæs. *De Bello Civili*, ii. 26, 42.) After the battle of Pharsalia, Cæsar proceeded into Africa to crush the remains of Pompey's party; but Juba, thinking this a favourable opportunity of destroying the troops of his opponent, collected a large army. He was soon, however, obliged to retire to the protection of his dominions, which were threatened by Sittius, the chief of a band of banditti. Appointing Sabura to the command of the troops against Sittius, he proceeded to rejoin Scipio at the head of a numerous army. The pride of Juba could not tolerate that Scipio should wear a purple cloak like his own, and Scipio did not think proper to offend his powerful ally on such a trivial point. A battle was fought, in which Cæsar defeated the allied army; and the Numidian prince fled to his own dominions, where he found Sabura had been defeated by Sittius. He wished to shut himself up in Zama; but the inhabitants gained by Cæsar having shut the gates of their city, Juba caused himself to be put to death (B. C. 46) by Petreius, one of his companions in misfortune (Liv. *Epit.* 114; Flor. iv. 2), or by a slave (Cæs. *Afr.* 94). Cæsar reduced the kingdom of Juba into the form of a province, and the historian Sallust was the first governor. (*Afr.* 97.)

JUBA II., the son of the former, was carried to Rome by Julius Cæsar on the defeat and death of his father, and formed one of the principal ornaments of the triumph which Cæsar enjoyed. At Rome the young prince received the benefit of an excellent education; and being naturally of an intelligent and thoughtful disposition, he soon equalled in learning and knowledge the wisest philosophers of Greece and Rome. (Plut. *Cæs.* 55.) Augustus became attached to him from his excellent qualities, and gave him in marriage Selene, or Cleopatra, the daughter of Antony and Cleopatra. (*Anton.* 87.) He was restored to the kingdom of his father by Augustus, and some parts of Gætulia were added to it. The Gætulians, unwilling to acknowledge themselves tributary to a prince imposed upon them by the Romans, made incursions into his territory, which he was unable to repel until he received assistance from Augustus. (Dion Cass. li. liii.) He was more fortunate in peace than in war, and made himself so much beloved by his subjects, that they placed him in the number of their gods, and erected statues to his honour. Pliny states, that the profound knowledge of Juba made him more illustrious than even his crown. He wrote many historical works of great value: the Antiquities of Assyria and of Rome; a History of Arabia, which he dedicated to the young Caius Cæsar; a History of Painting and of Painters; a History of Theatres, many fragments of which still remain; on the Nature and Qualities of different Animals; a Treatise on the Plant Euphorbia; and an Essay on the source of the Nile.

JUBILEE, amongst the Jews, denotes every fiftieth year, being that following the revolution of seven weeks of years, at which time all the slaves were made free, and all lands reverted to their ancient owners. But the jubilees were disregarded after the Babylonian captivity. The word, according to some authors, comes from the Hebrew, *jobel*, which signifies *fifty;* but this must be a mistake, for the Hebrew, *jobel*, does not signify fifty, neither do its letters, taken as ciphers, or according to their numerical powers, make up that number, these being 10, 6, 2, and 30, or in all 48. Others say, that *jobel* signifies a *ram*, and that the jubilee was so called, because proclaimed with a ram's horn, in memory of the ram which appeared to Abraham in the thicket. Masius chooses to derive the word from *Jubal*, the first inventor of musical instruments, which for that reason were called by his name; and hence the words *jobel* and *jubilee* came to signify the year of deliverance and remission, because proclaimed with the sound of one of those instruments, which at first was no other than the horn of a ram. Others derive *jobel* from יבך, *jabal*, in hiphil, הֹבִיל, *hobil*, which signifies to recall or return; because this year restored all slaves to their liberty, and recalled exiles to their native land. The institution of this festival is to be found in Leviticus (chap. xxv. v. 8–17).

The learned are divided about the year of jubilee; some maintaining that it occurred every forty-ninth, and others that it took place every fiftieth year. The ground of the former opinion is chiefly this, that the forty-ninth year being of course a sabbatical year, if the jubilee had been observed on the fiftieth, the land must have had two sabbaths, or have lain fallow two years, which, without a miracle, would have produced a scarcity. On the other hand, it is alleged, that the Scripture expressly declares for the fiftieth year (Levit. xxv. 10, 11): and, besides, if the jubilee and sabbatical year had been the same, there would have been no need for a prohibition against sowing or reaping, because this kind of labour was prohibited by the law of the sabbatical year (Levit. xxv. 4, 5). The authors of the Universal History (book i. chap. 7, note R) endeavour to reconcile these opinions, by observing, that as the jubilee began in the first month of the civil year, which was the seventh of the ecclesiastical, it might be said to be either the forty-ninth or fiftieth, according as one or other of these computations was followed. The political design of the law of the jubilee was to prevent the oppression of the poor, as well as to obviate their being liable to perpetual slavery. By this means a kind of equality was preserved amongst all the families of Israel, and the distinction of tribes was also preserved, that they might be able, when there was occasion, on the jubilee year, to prove their right to the inheritance of their ancestors. It served also, like the *olympiads* of the Greeks, and the *lustra* of the Romans, for the computation of time. The jubilee has likewise been supposed to be typical of the gospel state and dispensation, described by Isaiah (lxi. ver. 1, 2, in reference to this period) as the "acceptable year of the Lord."

Jubilee, in a more modern sense, denotes a grand solemnity or ceremony, celebrated at Rome, in which the pope grants a plenary indulgence, at least to as many as visit the churches of St Peter and St Paul.

The jubilee was first established by Boniface VII. in the year 1300, in favour of those who should proceed *ad limina apostolorum;* and it was only to return every hundred years. But the first celebration brought in such store of wealth to Rome, that the Germans called this the *golden year;* a circumstance which induced Clement VI. in 1343, to reduce the period of the jubilee to fifty years. Urban VI. in 1389 appointed it to be held every thirty-five years, that being the age of our Saviour; and Paul II. and Sixtus IV. in 1475 brought it down to every twenty-five years, that all persons might have the benefit of it once in their lifetime. Boniface IX. granted the privilege of holding jubilees to several princes and monasteries; for instance, to the monks of Canterbury, who had a jubilee every fifty years, when people flocked from all parts to visit the tomb of St Thomas-a-Becket. Jubilees are now become more frequent, and the pope grants them as often as the church or himself has occasion for them. There is usually one at the inauguration of a new pope. To be entitled to the privileges of the jubilee, the bull enjoins fastings, alms, and prayers. It gives the priests full power to absolve in all cases, even those otherwise reserved to the pope, to make commutations of vows, and to perform other functions, in which it differs from a plenary indulgence. During the time of jubilee all other indulgences are suspended.

One of our kings, Edward III., caused his birth-day to be observed in the manner of a jubilee when he became fifty years of age, in 1362, but never before nor after; and this he did by releasing prisoners, pardoning all offences except treason, making good laws, and granting many privileges to the people.

There are particular jubilees in certain cities, when several of their feasts fall upon the same day; at Puy-en-Velay, for instance, when the feast of the Annunciation happens on Good Friday; and at Lyons, when the feast of St John Baptist concurs with the feast of Corpus Christi. The Jesuits celebrated a solemn jubilee at Rome in 1640, that being the centenary or hundredth year from their institution; and the same ceremony was observed in all their houses throughout the world.

JUDAH, the fourth son of Jacob, and father of the chief of the tribes of the Jews, distinguished by his name, and honoured by giving birth to the Messiah, died in the year before Christ 1636.

Judah Hakkadosh, or the Saint, a rabbi celebrated for his learning and riches, who lived in the time of the Emperor Antoninus, and was the friend and preceptor of that prince. Leo of Modena, a rabbi of Venice, tells us that Rabbi Judah, who was very rich, collected, about twenty-six years after the destruction of the temple, in a book which he called *Misnia*, the constitutions and traditions of the Jewish magistrates who had preceded him. But as this book was short and obscure, two Babylonian rabbin, Rabbina and Ase, collected all the interpretations, disputes, and additions, which had been made upon the *Misnia* until their time, and formed the book called the *Babylonian Talmud* or *Gemara*, which is preferable to the Jerusalem Talmud, composed some years before by Rabbi Jochonan of Jerusalem. The *Misnia* is the text of the Talmud, of which there is a good edition in Hebrew and Latin by Surenhusius, with notes, in three vols. folio. It were to be wished that as much had been done for the Gemara.

The Kingdom of Judah was of small extent compared with that of the kingdom of Israel, consisting only of two tribes, Benjamin and Judah. Its eastern boundary was the Jordan; on the west it had the Mediterranean in common with the Danites, if we except some places taken by the kings of Israel, which had been recovered by the Philistines and others; on the south its limits seem to have been contracted under Hadad, of the royal family of Edom (1 Kings, xi. 14).

Tribe of Judah, one of the twelve divisions of Palestine by tribes (Josh. xv.), having Idumea on the south, from the extremity of the Lake Asphaltites, and also the wilderness of Zin, Cadesbarnea, and the brook or river of Egypt;

on the east the Lake Asphaltites; on the west the Mediterranean; and on the north the mouth of the lake, where it receives the Jordan, Bethsemes, and Thimna, as far as Ekron on the sea.

JUDAISM, the religious doctrines and rites of the Jews. Judaism was but a temporary dispensation, and destined to give way, at least the ceremonial part of it, at the coming of the Messiah. For a complete system of Judaism, it is only necessary to refer to the books of Moses. Judaism was anciently divided into several sects, the principal of which were the Pharisees, Sadducees, and Essenians. At present there are but two sects amongst the Jews, viz. the Caraites, who admit of no rule of religion but the law written by Moses; and the Rabbinists, who add to the law the traditions of the Talmud.

JUDAS MACCABEUS, a celebrated general of the Jews, renowned for the many victories which he gained over his enemies, was at last slain in battle, 261 before Christ. See JEWS.

JUDE, ST, brother of St James the younger, and son of Joseph (Mat. xiii. 55). He preached in Mesopotamia, Arabia, Syria, Idumea, and died in Berytus for the profession of the faith of Christ. He wrote the epistle which goes under his name, and which was composed after the death of most of the apostles. He was cruelly put to death for reproving the superstition of the Magi.

JUDE, or *the General Epistle of Jude*, a canonical book of the New Testament, written against the heretics, who, by their disorderly lives and impious doctrines, corrupted the faith and morals of the Christians. St Jude draws them in lively colours, as men given up to their passions, full of vanity, and conducting themselves by worldly wisdom, and not by the spirit of God.

JUDEA, or JUDÆA, in *Ancient Geography*, taken largely, denotes either all Palestine, or the greater part of it, and thus it is generally employed in the Roman history; Ptolemy, Rutilinus, Jerome, Origen, and Eusebius, using the word to signify the whole of Palestine. Here we consider it as denoting the third part of the country on this side of the Jordan, the southern part being distinct from Samaria and Galilee; and under such restriction it is often employed, not only in Josephus, but also in the New Testament. It contained four tribes, Judah, Benjamin, Dan, and Simeon, together with Philistia and Idumea; and hence it was included between Samaria on the north, Arabia Petræa on the south, the Mediterranean on the west, and the Lake Asphaltites, with part of Jordan, on the east. Josephus divides it into eleven toparchies, and Pliny into ten; so that, according to both, it had a greater extent than that which is just mentioned. See PALESTINE.

JUDENBURG, a circle of the Austrian province of Steyermark, extending over 2312 square miles, and containing five cities with their suburbs, fourteen market-towns, and 387 villages, with 16,624 houses, and 87,388 inhabitants. The chief place, which gives its name to the circle, is situated on the river Mur, in the most fertile part of the province. It contains three churches, and 1684 inhabitants, living in 260 houses. Long. 14. 35. 25. E. Lat. 47. 23. 29. N.

JUDEX, MATTHEW, one of the principal writers of the Centuries of Madgeburg, was born at Tipplcswolde in Misnia in 1528. He taught theology with great reputation; but, owing to party feuds, met with many annoyances in the exercise of his ministry. He wrote several works, and died in 1564.

JUDGE, a chief magistrate of the law, appointed to hear causes, to explain the laws, and to pronounce sentence.

JUDGES, in Jewish antiquity, certain supreme magistrates who governed the Israelites from the time of Joshua till the reign of Saul. These judges resembled the Athenian archons and the Roman dictators. The dignity of judge was for life, but not always in uninterrupted succession. God himself, by an express declaration of his will, regularly appointed the judges. The Israelites, however, did not always wait for his appointment, but sometimes chose for themselves a judge in times of danger. The power of the judges extended to affairs of peace and war. They were protectors of the law, defenders of religion, and avengers of all crimes; but they could make no laws, nor impose any new burdens upon the people. They lived without pomp or retinue, unless their own fortunes enabled them to do so; for the revenues of their office consisted in voluntary presents from the people. They continued from the death of Joshua till the beginning of the reign of Saul, being a space of about 339 years.

JUDGES, in ordinary affairs, civil and religious, were appointed by Moses in every city, to terminate differences; but in affairs of greater consequence, the differences were referred to the priests of Aaron's family, and the judge of the people or prince at that time established. Moses likewise established two courts in all the cities; one consisting of priests and Levites, to determine points concerning the law and religion; the other consisting of heads of families, to decide in civil matters.

Book of JUDGES, a canonical book of the Old Testament, so called from its relating to the state of the Israelites under the administration of those illustrious persons who were called *judges*, from being both the civil and military governors of the people, and who were raised up by God upon special occasions after the death of Joshua till the time of their making a king. In the time of this peculiar polity, there were several remarkable occurrences, which are recorded in this book. It acquaints us with the gross impiety of a new generation which sprung up after the death of Joshua; and it gives us a short view of the dispensations of heaven towards this people, sometimes relieving and delivering them, and at others severely chastising them by the hands of their enemies.

Select JUDGES (*Judices selecti*), in *Antiquity*, were persons summoned by the prætor to give their verdict in criminal matters in the Roman courts, as juries do in ours. No person could be regularly admitted into this number till he was twenty-five years of age. The *Sortitio Judicum*, or impannelling of the jury, was the office of the *Judex Questionis*, and was performed after both parties had come into court, each having a right to reject or challenge whomsoever he pleased. The number of the *Judices selecti* varied, according to the nature of the charge. When the proper number appeared, they were sworn, took their places in the *subsellia*, and heard the trial.

JUDGMENT, amongst logicians, is a faculty or rather an act of the human soul, by which it compares its ideas, and perceives their agreement or disagreement. See METAPHYSICS and LOGIC.

JUDGMENT, in *Law*, is the sentence pronounced by the court upon the matter contained in the record. In the law of England, judgments are of four sorts; first, where the facts are confessed by the parties, and the law determined by the court, as in the case of judgment upon demurrer; secondly, where the law is admitted by the parties, and the facts disputed, as in the case of judgment upon verdict; thirdly, where both the fact and the law arising thereon are admitted by the defendant, which is the case of judgments by confession or default; or, lastly, where the plaintiff is convinced that either fact or law, or both, are insufficient to support his action, and therefore abandons or withdraws his prosecution, which is the case in judgments upon a *nonsuit* or *retraxit*.

JUDGMENT, in criminal cases, is the next stage of prosecution, after trial and conviction, in such crimes and misdemeanours as are either too high or too low to be included within the benefit of clergy. For when, upon a capital charge, the jury have brought in their verdict guilty in the presence of the prisoner, he is either immediately, or at a convenient time soon afterwards, asked by the court, if he has any thing to offer why judgment should not be awarded against him? And in case the defendant be found guilty of a misdemeanour (the trial of which may, and does usually, happen in his absence, after he has once appeared), a *capias* is awarded and issued, to bring him up to receive his judgment; and if he absconds, he may be prosecuted even to outlawry. But whenever he appears in person, upon either a capital or inferior conviction, he may at this period, as well as at his arraignment, offer any exceptions to the indictment, in arrest or stay of judgment; as for want of sufficient certainty in setting forth either the person, the time, the place, or the offence. And if the objections be valid, the whole proceedings are set aside; but the party may be indicted again.

A pardon also may be pleaded in arrest of judgment; and it has the same advantage when pleaded here as when pleaded upon arraignment, namely, saving the attainder, and, of course, the corruption of blood; which nothing can restore but parliament, when a pardon is not pleaded till after sentence. Praying the benefit of clergy may also be ranked amongst the motions in arrest of judgment.

If all these resources fail, the court must proceed to pronounce that judgment which the law has annexed to the crime. Of these some are capital, which extend to the life of the offender, and consist generally in being hanged by the neck till dead; though in very atrocious crimes other circumstances of terror, pain, or disgrace, are superadded. Some punishments consist in exile or banishment, by abjuration of the realm, or transportation beyond the seas; others, in loss of liberty, by perpetual or temporary imprisonment. Some extend to confiscation, by forfeiture of lands or moveables, or both, or of the profits of lands for life; others induce a disability of holding offices or employments, of being heirs, executors, and the like. Some, though rarely, occasion a mutilation or dismembering, by cutting off the hand or ears; others fix a lasting stigma on the offender, by slitting the nostrils or branding in the hand or face. Some are merely pecuniary, by stated or discretionary fines; and there are others which consist principally in the ignominy, though most of them are mixed with some degree of corporal pain.

JUDICATURE, the quality or profession of those who administer justice.

JUDICATURE is also used to signify the extent of the jurisdiction of the judge, and the court in which he sits to render justice.

JUDICIA CENTUMVIRALIA, in Roman antiquity, were trials before the *Centumviri*, to whom the prætor committed the decision of certain matters of inferior nature, like our justices of the peace at the quarter-sessions. During the *judicia centumviralia*, a spear was stuck up in the forum, to signify that the court was sitting.

JUDICIUM CALUMNIÆ was an action brought against the plaintiff for false accusation. The punishment, upon conviction, was *inustio frontis*, or branding in the forehead.

JUDICIUM Dei, Judgment of God, was a term anciently applied to all extraordinary trials of secret crimes, as those by arms and single combat, and the ordeals, or those by fire or red-hot ploughshares, by plunging the arm in boiling water, or the whole body in cold water, in hopes that God would work a miracle rather than suffer truth and innocence to perish. These customs were a long time kept up even amongst Christians; and they are still in use amongst some nations. Trials of this sort were usually held in churches in presence of the bishops, priests, and secular judges, after three days' fasting, confession, and communion, with many adjurations and ceremonies, which are described at large by Du Cange.

JUDICIUM Parium denotes a trial by a man's equals, that is, of peers by peers, and of commoners by commons. In Magna Charta it is more than once insisted on as the principal bulwark of our liberties, that no freeman shall be hurt either in his person or in property, *nisi per legale judicium parium suorum vel per legem terræ*. And this was esteemed in all countries a privilege of the highest and most beneficial nature.

JUDICIUM Falsi was an action which lay against the judges for corruption or unjust proceedings.

JUDICIUM Prævaricationis was an action brought against the prosecutor, after the criminal was acquitted, for suppressing the evidence of, or extenuating, his guilt, rather than urging it home, and bringing it to light.

JUGERUM, in Roman antiquity, a square of 120 Roman feet, being to the English acre as 10·000 to 16·097.

JUGGERNATH, properly JAGATNATHA, the Lord of the World, a celebrated temple and place of Hindu worship, on the sea-coast of Orissa, and district of Cuttack, near to the town of Pursolem, esteemed the most sacred of all the Hindu religious establishments. It is situated a few miles to the north-east of the Chilka Lake, close to the sea-shore, and, when seen from a distance, is a shapeless mass of building, but forms an excellent landmark for navigators in approaching so low a coast. It is surrounded by several courts or inclosures, into the interior of which no European is admitted; and at the gate of the outward wall are two large statues of singhs, an imaginary or fabulous animal, nearly as large as an elephant. Juggernath is said to be one of the incarnations of Vishnu; but the original dedication of the temple is involved in fable. It is known to have existed for above 800 years, and is mentioned as a celebrated place of Hindu worship by the oldest Mahommedan historians of India. The idol itself is a huge disgusting image of the human form, made of wood, with a frightful black visage, and a distended mouth foaming with blood. On each side of him is another image, one part of which is painted white, and the other yellow; the first is said to be the image of his sister Shubudra, the other that of his brother Balaram. The throne of the idol is placed on a stupendous car or moveable tower, about sixty feet high, resting on wheels, which, from the weight, indent the ground deeply as they move along; and it is then that, in the fanatical madness of his bloody superstition, devotees throw themselves under the wheels and are crushed to death. The tower is drawn along by the people by means of ropes, amidst the shouts of the ignorant multitude; and upon the car are the priests and attendants. The concourse of Hindu pilgrims to this shrine is immense; the aged come to die at Juggernath; and so numerous are these pilgrims, that the approach to it is known at the distance of fifty miles by the quantity of human bones strewed on the way. The impurity of the Hindu idolatry is strongly indicated by the indecent sculptures that cover the walls of the temple and the sides of the machine.

The resort of Hindu pilgrims to Juggernath is the source of a considerable revenue; and the British, by the conquest of the province of Cuttack from the Mahrattas in 1803, have succeeded to all their rights as sovereigns, and consequently to the right of collecting this tax on the superstition of the inhabitants. The superintendence of the temple and of its interior economy was conferred on the rajah of Khoordah. The sum realized by the company from this singular source of revenue is very trifling, not exceeding 11,000 or 12,000 rupees. The tax amounts to from ten to two rupees, according to the different classes of pilgrims, who are allowed access to the temple from thirty to four days. The devotees of low caste are, however, obliged to perform all their ceremonies on the outside of the temple. A great number of pilgrims, including all devotees and religious persons, are admitted gratuitously to the temple. Merchants and traders have access to the town of Parsottom, which is adjacent to the idol; but they have no access to the temple except by permission. One of the chief periods of pilgrimage is in March, when the Dole Jattrah takes place; and the other in July, when the Ruth Jattrah is celebrated. The travelling distance from Calcutta it 311 miles, from Benares 512, from Madras 719, from Delhi 910, and from Bombay 1052 miles. Long. 86. 5. E. Lat. 19. 49. N.

JUGGLERS, a kind of people whose profession, namely, to perform slight-of-hand tricks, has not often been deemed either respectable or useful. Yet Professor Beckmann, in the third volume of his *History of Inventions*, defends them, and pleads ably the cause of the practitioners of legerdemain, including rope-dancers, and such as exhibit feats of uncommon strength. He places all these under the general denomination of jugglers; and taking it for granted that every useful employment is full, he contends, strangely enough, that there would not be room on the earth for all its present inhabitants, did not some of them practise the art of juggling.

These arts, he observes, are not unprofitable, for they afford a comfortable subsistence to those who practise them, which they usually spend upon the spot; and this he considers as a good reason why their sojourning in a place ought to be encouraged. He is also of opinion, that if the arts of juggling served no other end than to amuse the most ignorant of our citizens, it is proper that they should be encouraged, for the sake of those who cannot enjoy the more expensive deceptions of an opera. They convey instruction in the most acceptable manner, and serve as an antidote to superstition. We scarcely think, however, that it is innocent to entice the labouring poor, by useless deceptions, to part with their hard-earned pittance to idle vagabonds, whose life cannot be comfortable, being passed amidst scenes of the most grovelling dissipation.

Juggling is certainly of very great antiquity. The deception of breathing out flames was practised by some of the slaves in Sicily about 150 years before the commencement of the Christian era. It is, however, practised in modern times with much greater dexterity. The ancients made use of naphtha, a liquid mineral oil, which kindles when it only approaches a flame. According to Plutarch, Alexander the Great was astonished and delighted with the secret effects of naphtha, which were exhibited to him at Ecbatana. Wonder has been excited in modern times by persons walking over burning coals or red-hot iron; but this is easily done by rendering the skin of the feet callous and insensible, so that the nerves under it are secured from injury. We are told by Beckmann that the Hirpi, who dwelt near Rome, jumped through burning coals; that women were accustomed to walk over burning coals at Castabala, near the temple dedicated to Diana; that the exhibition of cups and balls is often mentioned in the works of the ancients; and that the various feats of horsemanship exhibited in our circuses passed, in the thirteenth century, from Egypt to the Byzantine court, and thence over all Europe.

JUGLANS, the Walnut, a genus of plants belonging to the polyandria class, and in the natural method ranking under the fiftieth order *Amentaceæ*. See Botany.

JUGULAR, amongst anatomists, is applied to certain veins and glands of the neck. See Anatomy.

JUGULARES, in the Linnæan system, is the name of an order or division of fish, the general character of which is, that the ventral fins are placed before the pectoral. See Ichthyology.

JUGUM, an humiliating mode of punishment inflicted by the victorious Romans upon their vanquished enemies. It was done in this way: They set up two spears, and laying a third across, in the form of a gallows, they ordered those who had surrendered themselves to pass under this ignominious erection, without arms or belts. None suffered this disgrace of passing *sub jugo* except such as had been obliged to surrender.

JUGURTHA, king of Numidia, was son of Mastanabal and a concubine; he was also grandson of Masinissa. The principal events of his life are included between 134 and 106 B. C. He was educated, along with his cousins Adherbal and Hiempsal, the sons of his uncle Micipsa, and began at an early period to exhibit such strong symptoms of ambition, that Micipsa felt much uneasiness respecting the succession of his sons to the throne. With a view, therefore, of getting rid of Jugurtha, when the Romans sent for auxiliaries in their war against Numantia, B. C. 134, Jugurtha was despatched at the head of a body of troops, and it was hoped that he might fall in some engagement with the enemy. The event did not correspond with his expectation; for he returned to Micipsa with letters from Scipio, who commanded the Roman troops, full of the most flattering expressions. When Micipsa found his end approaching, he saw it necessary to change his policy in respect to Jugurtha; and, hoping that gratitude might prevent him from gratifying his ambitious views, he named him joint heir with his two sons Adherbal and Hiempsal. But the third part of the kingdom did not satisfy Jugurtha, who began immediately to take measures for getting rid of his cousins. Hiempsal was murdered, and Adherbal only saved his life by a timely flight, B. C. 112. The fugitive prince had recourse to Rome, where the venality of the nobility had become proverbial, and made application to the senate. The bribes of Jugurtha prevented an adverse decision, and commissioners were appointed to divide the kingdom equally between the two princes. The most fertile and populous part of Numidia was given to Jugurtha, who, finding all his schemes succeed, began without delay to make war on his cousin. Having shut him up in the town of Cirta, Jugurtha induced him to surrender upon promise of his life, but, in contempt of all the laws of honour, put him to death. This atrocious proceeding roused the indignation of the people of Rome, and the senate could no longer withstand the popular feeling. War was declared, and carried on with vigour (B. C. 111), till the Numidian prince succeeded in bribing the generals sent against him. Peace was at last granted to him upon very advantageous conditions, and he had even the boldness to come to Rome, where he caused Massiva to be murdered, whose claims to his kingdom began to give him uneasiness. Nothing could now save him from the indignation of Rome, and he was ordered immediately to quit Italy. It was on leaving Rome that he is said to have frequently looked back on it, and to have exclaimed, "Urbs venalis et mature peritura si emptorem inveniet." The war began B. C. 110, but with little success to the Romans. Jugurtha defeated Aulus, who had been sent against him, and made his troops pass under the yoke. Metellus was next despatched to Africa, who, not allowing himself to be gained either by the promises or bribes of Jugurtha, soon reduced him to great difficulties. He took many of his chief cities, B. C. 109, and compelled Jugurtha to apply for assistance to the Gætulians and Moors. Marius followed up the war with still greater vigour, till Jugurtha was obliged at last to fly to Bocchus, who delivered him up to Sylla, then quæstor of Marius, B. C. 106. He was carried to Rome, where he was led in triumph

Juice.

by Marius, and afterwards perished in prison. His life has been written by Sallust, and some facts may be found in Plutarch's *Life of Marius* (c. 3), and Sylla (c. 10), and Diodorus Siculus, *Fragm.* tom. x. p. 141.

JUICE denotes the sap of vegetables, or the liquors of animals.

The juices of several plants are expressed to obtain their essential salts, and for several medicinal purposes, with intention either to be used without further preparation, or to be made into syrups and extracts. The general method of extracting these juices is, by pounding the plant in a marble mortar, and then by putting it into a press. In this way is obtained a muddy and green liquor, which generally requires to be clarified. The juices of all plants are not extracted with equal ease. Some plants, even when fresh, contain so little juice, that water must be added whilst they are pounded, otherwise scarcely any juice could be obtained by expression. Other plants, which contain a considerable quantity of juice, furnish by expression but a small quantity of it, because they contain also much mucilage, which renders the juice so viscid that it cannot flow. Water must also be added to these plants to obtain their juice. The juices thus obtained from vegetables by a mechanical method are not, properly speaking, one of their principles, but rather a collection of all the proximate principles of plants which are soluble in water; such is the saponaceous extractive matter, the mucilage, the odoriferous principle, and the saline and saccharine substances; all of which are dissolved in the water of the vegetation of the plants. Besides these matters, the juice contains some part of the resinous substance, and the green colouring matter, which in almost all vegetables is of a resinous nature. These two latter substances not being soluble in water, are only interposed between the parts of the other principles which are dissolved in the juice, and consequently disturb its transparency. They nevertheless adhere together in a certain degree, and so strongly in most juices, that they cannot be separated by filtration alone. When therefore these juices are to be clarified, some previous preparations must be used by which the filtration may be facilitated. Juices which are acid, and not very mucilaginous, are spontaneously clarified by rest and gentle heat. The juices of most antiscorbutic plants abounding in saline volatile principles, may be disposed to filtration merely by immersion in boiling water; and as they may be contained in close bottles, whilst they are thus heated in a water bath, their saline volatile part, in which their medicinal qualities chiefly consist, may thus be preserved. Fermentation is also an effectual method of clarifying juices which are susceptible of it; for all liquors which have fermented clarify spontaneously after fermentation. But this method is not used to clarify juices, because many of them are susceptible of only an imperfect fermentation, and because the qualities of most of them are injured by that process. The method of clarification most generally used, and indispensably necessary for those juices which contain much mucilage, is boiling with the white of an egg. This matter, which has the property of coagulating in boiling water, and of uniting with mucilage, does accordingly, when added to the juice of plants, unite with and coagulate their mucilage, and separates it from the juice in form of scum, together with the greatest part of the resinous and earthy matters which disturb its transparency. And as any of these resinous matters which may remain in the liquor, after this boiling with the whites of eggs, are no longer retained by the mucilage, they may be easily separated by filtration.

The juices, especially before they are clarified, contain almost all the same principles as the plant itself; because, in the operation by which they are extracted, no decomposition happens, but every thing remains, as to its nature, in the same state as in the plant. The principles contained in the juice are only separated from the grosser oily, earthy, and resinous parts, which compose the solid matter that remains under the press. These juices, when well prepared, have therefore the same medicinal qualities as the plants from which they are obtained. They must evidently differ from each other as to the nature and proportions of the principles with which they are impregnated, as much as the plants from which they are extracted differ from each other in those respects.

Juice.

Most vegetable juices coagulate when they are exposed to the air, whether they are drawn out of the plant by wounds, or naturally run out; though what is called naturally running out is generally the effect of a wound in the plant, from a sort of canker, or some other internal cause. Different parts of the same plant yield different juices. The same veins, in their course through the different parts of the plant, yield juices of a different appearance. Thus the juice in the root of the cow-parsnip is of a brimstone colour, but in the stalk it is white.

Amongst those juices of vegetables which are clammy and readily coagulate, there are some which readily break with a whey. The great wild lettuce, with the smell of opium, yields the greatest plenty of milky juice of any known British plant. When the stalk is wounded with a knife, the juice flows out readily like a thick cream, and is white and ropy; but if these wounds are made at the top of the stalks, the juice that flows out of them is dashed with a purple tinge, as if cream had been sprinkled over with a few drops of red wine. Some little time after letting this out, it becomes much more purple, and thickens; and finally, the thicker part of it separates, and the thin whey swims at the top. The whey or thin part of this separated matter is easily pressed out from the curd by squeezing between the fingers, and the curd will then remain white; and on washing with water it becomes like rags. The purple whey (for in this is contained all the colour) soon dries into a purple cake, and may be crumbled between the fingers into a powder of the same colour. The white curd being dried and kept for some time, becomes hard and brittle. It breaks with a shining surface like resin, and is inflammable, taking fire at a candle, and burning all away with a strong flame. The same thick part being held over a gentle heat, will draw out into tough, long threads, melting like wax. The purple cake made from the whey is quite different from this; and when held to a candle scarce flames at all, but burns to a black coal. The whole virtue of the plant seems also to consist in this thin part of its juice; for the coagulum or curd, though looking like wax or resin, has no taste at all; whereas the purple cake made from the serum is extremely bitter, and of a taste somewhat resembling that of opium.

Of the same kind with the wild lettuce are the throatwort, spurge, and many other plants. These are all replete with a milky juice which separates into curds and whey like that already described. But this, though a common law of nature, is not universal; for there are many plants which yield the like milky juices without any separation ensuing upon their extravasation. The white juice of the sonchus never separates, but dries into an uniform cake; the common red wild poppy bleeds freely with a milky juice; and the heads or capsules of seed bleed not less freely than the rest of the plant, even after the flower is fallen. The juice, on being received into a shell or other small vessel, soon changes its white to a deep yellow colour, and dries into a cake which seems resinous and oily, but no whey separates from it. The tragopogon, or goat's beard, when wounded, exudes freely a milky juice; it is at first white, but becomes immediately yellow, and then more and more red, till at length it is wholly of a dusky red. It never separates, but dries together into one cake; and is oily and resinous, but of an insipid taste. The great bindweed also exudes freely a white juice; the flowers, as well as the stalks and leaves, affording this liquor. It is of a sharp taste; and, as many of the purging plants are of this class, it would be worth trying whether this milk is not purgative.

These juices, as well as the generality of others which bleed from plants, are white like milk; but there are some of other colours. The juice of the great celandine is of a fine yellow colour; it flows from the plant of the thickness of cream, and soon dries into a hard cake, without any whey separating from it. Another yellow juice is yielded by the seed-vessels of the yellow centaury in the month of July, when the seeds are full grown. This is very clammy; it soon hardens altogether into a cake without any whey separating from it. It sticks to the fingers like bird-lime, is of the colour of pale amber, and will never become harder than soft wax if dried in the shade; but if laid in the sun it immediately becomes hard like resin. These cakes burn like wax, and emit a very pleasant smell. The great angelica also yields a yellowish juice on being wounded; and this will not harden at all, but if kept several years will still be soft and clammy, drawing out into threads or half-melted resin.

Other kinds of juices very different from all these are those of a gummy nature. Some of these remain liquid a long time, and are not to be dried without the assistance of heat; and others very quickly harden of themselves, and are not inflammable. The gum of the juice of rhubarb leaves soon hardens, and is afterwards soluble in common water, and sparkles when put into the flame of a candle. The clusters of the common honeysuckle are full of a liquid gum. This they frequently throw out, and it falls upon the leaves, where it retains its own form. The red hairs of the *ros solis* are all terminated by large bladders of a thin, watery fluid. This is also a liquid gum; it sticks to the fingers, draws out into long threads, and stands the force of the sun all day. In the centre of each of these dew-drops there is a small red bladder, which stands immediately on the summit of the red hair, and contains a purple juice which may be squeezed out of it. The pinguicula, or butterwort, has also a gummy matter on its leaves, in much greater quantity than the *ros solis*.

Some plants yield juices which are manifestly of an oily nature. These, when rubbed, are not at all of a clammy nature, but make the fingers glib and slippery, and do not at all harden on being exposed to the air. If the stalk of elecampane be wounded, there flows out an oily juice swimming upon a watery one. The stalks of the hemlock also afford a similar oily liquor swimming upon the other; and in like manner the white mullein, the berries of ivy, the bay, juniper, dogberry tree, and the fruit of the olive, when wounded, show their oil floating on the watery juice. Some of these oily juices, however, harden into a kind of resin. Our ivy yields such a juice very abundantly; and the juice of the small purple-berried juniper is of the same kind, being hard and fat, and not very gummy. If the bark of the common ivy is wounded in March, there will ooze out a tough and greasy matter of a yellowish colour, which, taken up between the fingers, feels not at all gummy or sticking, but melts in handling into a sort of oil, which in process of time hardens and crusts upon the wounds, and looks like brown sugar. It burns with a lasting flame, and smells very strong. The tops of the wild lettuce, and the leaves growing near the tops, if examined with a magnifying glass, show a great number of small bladders or drops of an oily juice of a brownish colour, hardening into a kind of resin; they are easily wiped off when of any size, and are truly an oily juice a little hardened. It is probable, also, that the fine blue flour or powder called the *bloom*, upon the surface of our common plums, is no other than such an oily juice exudating from their pores in small particles, and hardening into a sort of resin.

JUIST, an island in the German Ocean, belonging to the Hanoverian province of East Friesland. It has a Lutheran church, and 280 inhabitants, who live by fishing, and as mariners. Long. 6. 54. 53. E. Lat. 53. 41. 11. N.

JUJUBES, in the *Materia Medica*, the name of a fruit of the pulpy kind, produced on a tree which Linnæus considers as a species of rhamnus. See RHAMNUS.

The jujubes have been made a general ingredient in pectoral decoctions; but they are now seldom used on these occasions, and are scarcely at all heard of in prescription, or to be met with except in our shops.

JUL, or JOL, a Gothic word, signifying a "sumptuous treat," and particularly applied to a religious festival, first amongst the heathens, and afterwards amongst the Christians. By the latter it was given at Christmas, which is still known under the name of *Iul*, or *Yool*, in Denmark, Norway, Iceland, Sweden, and even in Scotland; and hence the month of Januarius was by the Saxons styled *Giuli*, or the "Festival." As this feast had originally been dedicated by our heathen ancestors to the sun, their supreme deity, so the Christians, for the purpose of engaging the minds of their Ethnic or gentile brethren, ordered that it should be celebrated in memory of the birth of Christ; and thus it has been through ages a feast of joy and entertainment. We are indebted to Procopius for the first account of this feast.

JULAMERICK, a district in the east of Kurdistan, bounded by Armenia on the north, and by the pachalic of Bagdad on the south. It is a hilly country throughout, producing in some places a quantity of corn, and in all abundance of pasturage. Its chief town bears the name of the province, and there are, besides, numerous villages. It contains a thousand inhabitants, and is situated on the banks of the Hakiar. It is defended by a citadel of stone, and is a hundred and twenty miles east-south-east of Betlis.

JULEP, in *Pharmacy*, a medicine composed of some proper liquor and a syrup or sugar, of extemporaneous preparation, without decoction.

JULIAN, the famous Roman emperor, styled *the Apostate*, because he professed the Christian religion before he ascended the throne, and afterwards, having embraced paganism, endeavoured to abolish Christianity. For this purpose, however, he made no use of violence. He knew that such measures had always rendered it more flourishing, and therefore behaved with a polite mildness to the Christians, recalling all who had been banished on account of their religion under the reign of Constantius. He undertook to pervert them by his caresses, and by temporal advantages or mortifications; forbidding Christians to plead before courts of justice, or to enjoy any public employments. He even prohibited their teaching polite literature, well knowing the great advantages which they drew from profane authors in their attacks upon paganism and irreligion. Though he on all occasions showed a sovereign contempt for the Christians, whom he called *Galileans*, yet he was sensible of the advantage they obtained by their virtue and the purity of their manners; and therefore he incessantly proposed their example to the pagan priests. At last, however, when he found that all other methods failed, he gave public employments to the most cruel enemies of the Christians, when the cities in most of the provinces were filled with tumults and seditions, and many of them were put to death. It has been pleaded by Julian's apologists, however, that the behaviour of the Christians afforded sufficient excuse for most of his proceedings against them; that the animosities amongst themselves furnished him with the means; that they were continually prone to sedition, and made a merit of insulting the public worship; and, finally, that they made no scruple of declaring, that want of numbers alone prevented them from engaging in open rebellion. Historians mention, that Julian attempted to prove the falsehood of our Lord's prediction with respect to the temple of Jerusalem; and resolved to have that edifice rebuilt by the Jews, about three centuries after its destruction by Titus; but all their endeavours served only the more perfectly to verify what had been foretold by Jesus Christ; for when the Jews, who had assembled from all parts to Jerusalem, were digging the foundations, flames of fire burst forth and consumed the workmen. However, the Jews, who were obstinately bent on accomplishing that work, made several attempts; but it is said that all who endeavoured to lay the foundation perished by these flames, which at last obliged them entirely to abandon the work. Julian having been mortally wounded in a battle with the Persians, is said to have caught in his hand some of the blood which flowed from his wound, and throwing it towards heaven, to have cried, "thou, Galilean, hast conquered." But notwithstanding this popular report, Theodoret relates, that Julian discovered a different disposition; and employed his last moments in conversing with Maximus the philosopher upon the dignity of the soul. He died the following night, at the age of thirty-two. For an account of his reign and exploits, see CONSTANTINOPOLITAN HISTORY.

No prince was ever more variously represented by different authors, on which account it is difficult to form a true estimate of his character. It must, however, be acknowledged, that he was learned, liberal, temperate, brave, vigilant, and a lover of justice; but, on the other hand, he had apostatised to paganism; he was a bitter enemy of the Christian religion; and he was also a persecutor, though not of the most sanguinary class. There have been preserved several of his discourses or orations; some of his letters; a treatise entitled *Misopogon*, which is a satire on the inhabitants of Antioch; and some other pieces, all written in an elegant style. They were published in Greek and Latin by Father Petau in 1630, in 4to; and Spanheimius published a fine edition in 1690, in folio. His most celebrated work was that composed against the Christians, of which some fragments are contained in Cyril's refutation.

JULIAN *Period*, in *Chronology*, a period so called, as being adapted to the Julian year. See CHRONOLOGY.

JULIAN, *St*, a town of the arrondissement of Joigny, in the department of the Yonne, in France. It contains 2340 inhabitants, who carry on considerable trade in wine, and manufacture woollen cloths.

JULIERS, a fortified city of Prussia, the capital of a circle of the same name, in the province of Aachen or Aix-la-Chapelle. It stands on the river Roer, the water of which fills the ditches that surround the walls. The citadel is a very strong frontier defence. It contains 460 houses, and 3290 inhabitants. The trade is inconsiderable. Long. 6. 25. E. Lat. 50. 55. N.

JULIO ROMANO. See ROMANO.

JULIUS CÆSAR. See CÆSAR.

JULIUS II. a pope, remarkable for his warlike disposition, and his political negotiations. By the latter, he induced the principal powers of Europe to unite with him against the republic of Venice, in the confederacy called *the league of Cambray*, signed in 1508. The Venetians having purchased peace by the cession of part of Romania, Julius turned his arms against Louis XII. king of France, and appeared in person, armed cap-á-pied, at the siege of Mirandola, which place he took by assault in 1511. But proceeding to excommunicate Louis, the king wisely turned his own weapons against him, by calling a general council at Pisa. The pope having refused to appear, was declared to be suspended from the holy see; and Louis, in his turn, excommunicated the pontiff, who died soon afterwards, in the year 1512. He built the famous church of St Peter at Rome, and was a patron of the polite arts.

JULIUS *Vicus*, in *Ancient Geography*, a town of the Nemetes, in Gallia Belgica, situated between the Tres Tabernæ and Noviomagus. It is now *Gemersheim*, a town of the Lower Palatinate, on the west side of the Rhine. Long. 15. 8. E. Lat. 49. 12. N.

JULIUS *Pollux*. See POLLUX.

JULY, the seventh month of the year, during which the sun enters the sign Leo. The word is derived from the Latin *Julius*, the surname of Cæsar the dictator, who was born in it. Mark Antony first gave this month the name *July*, which before was called *Quintilis*, as being the fifth month of the year in the old Roman calendar established by Romulus, which began in the month of March. For the same reason, August was called *Sextilis;* and September, October, November, and December, still retain the names of their original rank. On the 19th day of this month the dog-days are commonly supposed to commence, when, according to Hippocrates and Pliny, the sea boils, wine turns sour, dogs go mad, the bile is increased and irritated, and all animals decline and languish.

JULY-*Flowers*. See DIANTHUS, BOTANY.

JUMBASIER RIVER, a town of Hindustan, in the province of Gujerat, and district of Broach. It exports to Bombay and other places, cotton, grain, oil, and piece-goods. The tide rises from five to six fathoms. It is twenty-eight miles from the town of Broach. Long. 72. 58. E. Lat. 22. 5. N.

JUMNA. This celebrated river takes its rise in the Himalaya Mountains, probably on the southern side, where the Ganges has its rise, though its source has never been accurately explored. It flows through the province of Serinagur, in a southern direction, in a line nearly parallel to the Ganges, from which, at the village of Gurudwar, in latitude 32. 22. north, it is only forty miles distant, and is between 200 and 300 yards broad, after emerging from the mountains. The Jumna enters Hindustan in the province of Delhi, and directs its course, at the distance of sixty or seventy miles, in a parallel line to that of the Ganges, until, after passing the cities of Delhi and Agra, it falls into the Ganges at Allahabad, in which, as the holier and rather the larger stream, its name is absorbed. The length of the stream, including its windings, is estimated at 780 miles. The Jumna is only useful as a military barrier to the British territories during the rainy season, when all field operations are impracticable. At this period it may be navigated by flat-bottomed boats of considerable burden; but at other times it is of no utility to commerce. Above its junction with the Chumbul, or ten miles below the fort of Etayeh, it is fordable, except for a few weeks during the rainy season. From Calpee to its junction with the Ganges there is no obstruction, and only one place where, in the dry season, the passage is rendered difficult by a bank of limestone. It is mentioned by Bishop Heber that its waters act on strangers like the Cheltenham waters.

JUNAGUR, a town of Hindustan, in the province of Gujerat, possessed by an independent native chief, now one of the British allies. He and other chiefs engaged, in 1808, with the Bombay government, not to connive at piracy, and to permit a free and open commerce with the British vessels, on paying the stipulated duties.

JUNCI LAPIDEI, the name given by old authors to a species of coral of the tubularia kind, and composed of a congeries of small tubules. See HELMINTHOLOGY.

JUNCTURE, a joining or closing of two bodies. See JOINT.

Juncture, in *Oratory*, is a part of composition particularly recommended by Quintilian, and denotes such an attention to the nature of the vowels and consonants, in the connection of words, with reference to their sound, as will render their pronunciation most easy and pleasant, and best promote the harmony of the sentence. Thus the coalition of two vowels, occasioning a hollow and obscure sound, and likewise of some consonants, rendering it harsh and rough, should be avoided; nor ought the same syllable to be repeated at the beginning and end of words, because thereby the sound becomes harsh and unpleasant. The first verse in Virgil's *Æneid* is an example of juncture.

JUNCUS, the Rush, a genus of plants belonging to the hexandria class, and in the natural method ranking under the fifth order, *Tripetaloideæ*. See Botany.

JUNE, the sixth month of the year, during which the sun enters the sign of Cancer. The word comes from the Latin *Junius*, which some derive *a Junone;* and hence Ovid, in the sixth of his *Fasti*, makes the goddess say,

Junius a nostro nomine nomen habet.

Others rather derive it *a junioribus*, this being for young people what the month of May was for old ones. In this month is the summer solstice.

JUNGERPOOR, a town of Hindustan, possessed by native chiefs, situated in the province of Gujerat, ninety miles north-east from Ahmedabad. These chiefs are occasionally tributary to the Mahrattas. Long. 73. 38. E. Lat. 23. 49. N.

JUNGEYPOOR, a town of Bengal, district of Ranjeshy, situated on the eastern bank of the Bhagerutty River. It is the principal silk station of the East India Company. This establishment was erected in 1773, and in 1803 about 3000 persons were employed. The method employed in spinning the silk is the same as that employed in Italy, which was introduced as early as in 1762, by some natives of Italy sent over for that purpose by the Company. The worms are bred all over the country, under the care of women and children. The soil is favourable to the growth of the mulberry. The inhabitants are obliged to sell the choice cocoons to the Company's agent. The employment has no deleterious effects, although the smell is excessively disagreeable. It is seventeen miles north by west from Moorshedabad. Long. 88. 13. E. Lat. 24. 28. N.

JUNGLEBARRY, a town in the province of Bengal, district of Mymansingh, sixty miles north-east from Dacca. Long. 90. 42. E. Lat. 24. 27. N.

JUNIUS, Adrian, one of the most learned men of the age in which he lived, was born at Hoorn, in Holland, in the year 1511. He travelled into all parts of Europe, and practised physic with reputation in England, where, amongst other works, he composed a Greek and Latin lexicon, to which he added considerably above six thousand words; an *Epithalamium* on the marriage of Queen Mary with King Philip of Spain; and *Animadversa et de Como Commentarius*, which is the most applauded of all his works. He died in 1575.

Junius, *Francis*, professor of divinity at Leyden, was born at Bourges in 1545, and studied some time at Lyons. Bartholomew Aneau, who was principal of the college in that city, gave him excellent instructions as to the right method of prosecuting his studies. He was employed in public affairs by Henry IV., and at last invited to Leyden to be professor of divinity; an employment which he discharged with honour, till he was snatched away by the plague in 1602. Du Pin says he was a learned and judicious critic. He wrote, in conjunction with Emmanuel Tremellius, a Latin version of the Hebrew text of the Bible; and he also published Commentaries on the greater part of the Holy Scriptures, besides many other works, all in Latin.

Junius, *Francis*, or *Francis du Jon*, the son of the preceding, was born at Heidelberg in 1589. He at first designed to devote himself to a military life; but after the truce concluded in 1609, he applied himself entirely to study. He came to England in 1620, and lived thirty years in the Earl of Arundel's family. He was greatly esteemed, not only for his profound erudition, but also for the purity of his manners; and he was so passionately fond of the study of the northern languages, that being informed there were some villages in Friesland where the ancient language of the Saxons was preserved, he went and lived two years in that country. He returned to England in 1675; and, after spending a year at Oxford, retired to Windsor, in order to visit Vossius, at whose house he died in the year 1677. The university of Oxford, to which he bequeathed his manuscripts, erected a very handsome monument to his memory. He wrote, 1. *De Pictura Veterum*, which is admired by the learned, the best edition being that of Rotterdam in 1694; 2. An Explication of the old Gothic manuscript called the *Silver Manuscript*, because the four gospels are there written in silver Gothic letters, published with notes by Thomas Mareschal or Marshal; 3. A large commentary on the Harmony of the four Gospels by Tatian, which is still in manuscript; 4. A Glossary in five languages, in which he explains the origin of the northern languages, published at Oxford in 1745, in folio.

JUNK, in nautical language, a name given to any remnant or piece of old cable, which is usually cut into small portions, for the purpose of making points, mats, gaskets, sennit, and the like.

JUNKSEYLON, a considerable island on the western coast of the Malay peninsula, and situated at the south-east extremity of the Bay of Bengal. It is divided from the continent by a narrow isthmus of sand about a mile in length and half a mile in breadth, which is covered only at high water, the tide rising in the springs about ten feet. The island is about forty miles in length by fifteen in breadth, and has several small islands near it from one to six miles in circumference. There is another island sixteen miles east, named Pulo Pinjang, or Long Island, being twenty-three miles in length by eight in breadth, and divided from the main by a strait having two fathoms of water in the narrowest part. On the north side of the island is an excellent harbour, called Popra, which may be entered over a mud bar, during the spring-tides, by ships drawing twenty feet water. The anchorage round the island is generally good, with a mud bottom. A considerable trade was formerly carried on here, previously to the establishment of Prince of Wales' Island, in the Buggess prows, who resorted to Junkseylon in great numbers, and brought various mixed cargoes to sell for tin. It is still occasionally visited by country ships from Calcutta in their voyage eastward, which import coarse cutlery, China-ware, iron in bars, looking-glasses, opium, piece-goods, steel in faggots, tobacco, woollens, &c. From Prince of Wales' Island also are imported opium and piece-goods, and in return tin, edible bird-nests, which are found on the rocky coasts of the island, biche-de-mer, and elephants' teeth, are received. This island is noted for the production of tin, which is raised by the natives, and smelted by a Chinese, who farms the privilege from government. In 1782, when it was visited by numerous native traders, the mines yielded an average of 500 tons per annum. All kinds of coin are current, but the preference is given to Spanish dollars. Certain pieces of tin also circulate, which are shaped like the under half of a cone, and weigh about three pounds. But as the population, owing to the unsettled state of the country, has since decreased to about 6000 inhabitants, and the Siamese have mines closer to their capital, a very small supply is now derived from the island, not exceeding 46,600 pounds a year. The miners dig pits of from twelve to twenty feet deep; but seldom venture on a lateral shaft; and the ore is generally found in round or oblong masses, with well-defined crystals, and in quartz, or embedded in masses of half-decomposed granite.

Junkscylon enjoys a good climate. The heats are never violent. The rains begin in July, and continue to November, with frequent intermissions; after which fine weather succeeds, accompanied by cold north-easterly winds at night. There are no horses on the island, bullocks and buffaloes being here used for labour. Persons of consequence travel on elephants, which are brought from Mergui. The island breeds wild hogs and deer, a few tame goats, and poultry; but no sheep, domestic dogs, nor cats.

JUNNERE, a town of Hindustan, in the province of Aurungabad, forty miles north-north-east from Poonah. Long. 73. 51. E. Lat. 19. 3. N.

JUNOA, a town of Hindustan, in the province of Bahar, and district of Chuta Nagpoor, 183 miles north-west from Calcutta. Long. 85. 43. E. Lat. 23. 23. N.

JUNO, in Pagan worship, was the sister and wife of Jupiter, the goddess of kingdoms and riches, and was styled the Queen of Heaven. She presided over marriage and child-birth, and was represented as the daughter of Saturn and Rhea. She married Jupiter, but was not the most complaisant of wives; for, according to Homer, that god was sometimes obliged to make use of all his authority to keep her in due subjection; and the same author observes, that on her entering into a conspiracy against him, he punished her by suspending her in the air with two anvils fastened to her feet, and golden manacles on her hands, whilst all the other deities looked on without a possibility of helping her. However, her jealousy made her frequently find opportunities of interrupting her husband in the course of his amours, and prompted her to punish with unrelenting fury Europa, Semele, Io, Latona, and the rest of his mistresses. Juno, as the queen of heaven, preserved great state. Her usual attendants were Terror and Boldness, Castor, Pollux, and fourteen nymphs; but her most faithful follower was the beautiful Iris, or the rainbow. Homer describes her as riding in a chariot adorned with precious stones, the wheels of which were of ebony, and which was drawn by horses with reins of gold. But she is more commonly painted as drawn by peacocks. She was represented in her temple at Corinth seated upon a throne, with a crown on her head, a pomegranate in one hand, and in the other a sceptre with a cuckoo on its top. This statue was of gold and ivory. Some mythologists suppose that Juno signifies the air; and others, that she was the Egyptian Isis, who, being represented under various figures, was by the Greeks and Romans represented as so many distinct deities.

JUNONALIA, a festival observed by the Romans in honour of Juno. It was instituted on account of certain prodigies which happened in Italy, and was celebrated by matrons. In the solemnity two white cows were led from the temple of Apollo into the city through the gate called *Carmentalis*, and two images of Juno, made of cypress, were borne in procession. Then marched twenty-seven girls, habited in long robes, singing a hymn to the goddess; next came the decemviri, crowned with laurel, in vestments edged with purple. This pompous company, proceeding through the *Vicus Jugarius*, performed a dance in the great field of Rome; and thence they proceeded through the *Forum Boarium* to the temple of Juno, where the victims were sacrificed by the decemviri, and the cypress images were left standing. This festival is not mentioned in the *Fasti* of Ovid, but is fully described by Livy (lib. vii. dec. 3). The hymn used upon the occasion was composed by Livius the poet.

JUNTO, or JUNTA, in matters of government, denotes a select council for taking cognizance of affairs of great consequence, and requiring secrecy. In Spain and Portugal it signifies the same as convention, assembly, or board, amongst us. Thus, we meet with the junta of the three estates, of commerce, of tobacco, and the like.

JUPITER, the supreme god of the ancient Pagans. The theologists, according to Cicero, reckoned three Jupiters, the first and second of whom were born in Arcadia; and of these two, the one sprang from Æther, and the other from Cœlus. The third Jupiter was the son of Saturn, and born in Crete, where they pretended to show his sepulchre. Cicero in other places speaks of several Jupiters, who reigned in different countries. The Jupiter by whom the poets and mythologists understand the supreme god, was the son of Saturn, king of Crete. He would have been devoured by his father as soon as born, had not his mother Rhea substituted a stone instead of the child, which Saturn immediately swallowed. Saturn took this method to destroy all his male children, because it had been foretold by Cœlus and Terra that one of his sons would deprive him of his kingdom. Jupiter, being thus saved from his father's jaws, was brought up by the Curetes in a den on Mount Ida. Virgil tells us that he was fed by the bees; and, out of gratitude for this service, he changed them from an iron to a golden colour. Some say that his nurses were Amalthæa and Melissa, who gave him goat's milk and honey; and others, that Amalthæa was the name of the goat which nourished him, and which, as a reward for her great services, was changed into a constellation. According to others, he was fed by wild pigeons, which brought him ambrosia from Oceanus; and by an eagle, which carried nectar in his beak from a steep rock; services for which he rewarded the former, by making them the foretellers of winter and summer; and the latter, by giving him immortality, and making him his thunderbearer. When grown up, he drove his father out of heaven, and divided the empire of the world with his brothers. For himself, he reserved heaven and earth; Neptune had allotted to him the sea and waters; and Pluto the infernal regions. The Titans undertook to destroy Jupiter, as he had done his father. These Titans were giants, the sons of Titan and the Earth. They declared war against Jupiter, and heaped mountains upon mountains in order to escalade heaven; but their efforts were unsuccessful, Jupiter overthrew them with his thunder, and shut them up under the waters and mountains, from which they were not able to escape. Jupiter had several wives. The first of these, named Metis, he is said to have destroyed in a most extraordinary manner. His second was Themis; the name of his third is not known; but his fourth was the celebrated Juno, whom he deceived under the form of a cuckoo, which, to shun the violence of a storm, fled for shelter to her lap. He was the father of the Muses and Graces, and had a prodigious number of children by his mistresses. He metamorphosed himself into a satyr to enjoy Antiope; into a bull, to carry off Europa; into a swan, to abuse Leda; into a shower of gold, to corrupt Danäe; and into several other forms to gratify his passions. He had Bacchus by Semele, Diana and Apollo by Latona, and was the father of Mercury and the other gods. The heathens in general believed that there was but one supreme God; but when they considered this one great being as influencing the affairs of the world, they gave him as many different names; and hence proceeded their variety of nominal gods. When he thundered or lightened, they called him

Jupiter; when he calmed the sea, Neptune; when he guided their councils, Minerva; and when he gave them strength in battle, Mars. In process of time they used different representations of this Jupiter, and considered them, vulgarly at least, as so many different persons. They afterwards regarded each of them in different views; thus, the Jupiter who showered down blessings was called the *Kind*; and the Jupiter who punished, the *Terrible*. There was also one Jupiter for Europe, and another for Africa. In Europe, there was one great Jupiter who was the particular friend of the Athenians, and another who was the special protector of the Romans; nay, there was scarcely a town or hamlet perhaps in Italy that had not a Jupiter of its own; but the Jupiter of Terracina, or Jupiter Anxur, represented in medals as young and beardless, with rays round his head, resembled Apollo more than the great Jupiter of the Capitol. In this way Jupiter at length had different temples and different characters almost everywhere. At Carthage, he was called Ammon; in Egypt, Serapis; at Athens, the Olympian Jupiter; and at Rome, the Capitoline Jupiter, who was the guardian and benefactor of the Romans, and whom they called the best and greatest, *Jupiter optimus maximus*. The figure of this Jupiter was represented, in his chief temple on the Capitoline Hill, as sitting on a curule chair, with the *fulmen* or lightning in one hand, and a sceptre in the other. This *fulmen*, in the figures of the old artists, was always adapted to the character under which they required to represent Jupiter. If his appearance was to be mild and calm, they gave him the comic *fulmen*, or bundle of flames wreathed close together, held down in his hand; when punishing, he held up the same figure, with two transverse darts of lightning, sometimes with wings added to each side of it to denote its swiftness (this was called by the poets the three-forked bolt of Jove); and when he was going to do some exemplary execution, they put in his hand a handful of flames, all let loose in their utmost fury, and sometimes filling both his hands with flames. The superiority of Jupiter was principally manifested in that air of majesty which the ancient artists endeavoured to express in his countenance; particular attention being paid to the head of hair, the eyebrows, and the beard. There are, on ancient seals, several heads of the mild Jupiter; where his face has a mixture of dignity and ease in it, admirably described by Virgil (*Æn.* i. ver. 256). The statues of the Terrible Jupiter were generally of black marble, as those of the former were of white; the one sitting with an air of tranquillity, the other standing, more or less disturbed. The face of the one is pacific and serene, of the other angry or clouded. On the head of the one the hair is regular and composed; in the other it is so dishevelled that it falls half way down the forehead. The face of the Jupiter Tonans resembles that of the Terrible Jupiter; he is represented on gems and medals as holding up the triple bolt in his right hand, and standing in a chariot which seems to be whirled on impetuously by four horses. Thus he is also described by the poets (Ovid, *Deian. Herc.* v. 28; Horace, lib. i. od. 4, v. 8). Jupiter, as the intelligence presiding over a single planet, is represented only in a chariot and pair; upon all other occasions, if represented in a chariot, he is always drawn by four horses. Jupiter is well known as the chief ruler of the air, whose particular province it was to direct the rains, the thunders, and the lightnings. As the dispenser of rain, he was called *Jupiter Pluvius*, under which character he is exhibited seated in the clouds, holding up his right hand, or extending his arms almost in a straight line each way, and pouring a stream of hail and rain from his right hand upon the earth, whilst the *fulmen* is held down in his left. The wings that are given to him relate to his character of presiding over the air; his hair and beard in the Antonine pillar are all spread down by the rain, which descends in a sheet from him, and falls for the refreshment of the Romans; whilst their enemies are represented as struck with the lightnings, and lying dead at their feet.

Some are of opinion that the fable of Jupiter includes a great part of the history of Noah and his three sons, and that Saturn is Noah, who saw all mankind perish in the waters of the deluge, and who, in some sort, swallowed them up, by not receiving them into the ark. Jupiter is Ham; Neptune, Japheth; and Shem, Pluto. The Titans, it is thought, represent the old giants, who built the tower of Babel, and whose pride and presumption God had confounded, by changing their language, and pouring out the spirit of discord and division amongst them. The name of *Jupiter*, or *Zeus*, or *Jovis Pater*, is thought to be derived from Jehovah; and in medals we meet with *Jovis* in the nominative as well as oblique cases, thus, *Jovis custos*, *Jovis propugnator*, *Jovis stator*. To the name *Jovis* was added *pater*; and afterwards, instead of *Zeus* or *Jovis Pater*, they used *Jupiter* by abbreviation.

The name of Jupiter was not known to the Hebrews till the reign of Alexander the Great, and the kings his successors. Antiochus Epiphanes commanded the idol of Jupiter Olympius to be placed in the temple at Jerusalem; and that of Jupiter the defender of strangers in the temple on Mount Gerizim (2 Macc. vi. 2). Whilst St Paul and St Barnabas were at Lystra, they were taken for gods, because they cured one who had been lame from his birth, and that by an expression only; St Paul was taken for Mercury, by reason of his eloquence, and St Barnabas for Jupiter (Acts, xiv. 11, 12), on account of his goodly mien.

JUPITER, ♃, in *Astronomy*, one of the superior planets, remarkable for its brightness, and which by its proper motion revolves round the earth in about twelve years. See ASTRONOMY.

JURA, one of the Hebrides, or Western Islands of Scotland, lying opposite to Knapdale in Argyleshire, is supposed to be about thirty-four miles in length and ten in breadth. It is the most rugged of all the Hebrides, and is composed chiefly of vast mountains, naked, and without a possibility of cultivation. See SCOTLAND.

JURA, one of the departments of the north-east of France. It is formed out of what was formerly called Higher Burgundy, is bounded on a part of its eastern frontier by Switzerland, and on all other sides by French departments. It is about sixty-six miles in length from north to south, and about thirty-eight in breadth from east to west, comprehending 1388 square miles. The department may be classed under three heads; first, the plains on the western side, which are fertile; second, the first steps of the mountains, which suddenly rise like a wall, extending from ten to twelve miles, above which is an extensive plateau mixed with hills, between which are some valleys, which, though stony, are of moderate fertility; the third division, which comprises nearly two thirds of the whole, is a mountainous district, but none of its summits exceed 5500 feet in height. These mountains are on the eastern side of the department; the most remarkable are the Reculet, 5200 feet; the Dole, 4950 feet; and the Poupet, somewhat lower. The woods, according to the *Description Topographique et Statistique*, cover one quarter of the whole surface. This department is the source of the small rivers Tansche, Dorrain, Deffoy, and some others; but a great part is watered by the Doubs and the Ain, and there are within it several lakes. The climate varies with the elevation, and the snow in the eastern parts is often so deep as to prevent all communication. The different parts produce wheat, barley, maize, and buck-wheat; a little excellent and much middling wine, abundance of fuel, and some very good cattle, especially horses. There are some mines of iron, and manufactures of various articles from it. The department is divided into four arrondissements, and subdivided into thirty-two cantons and 728 communes, inhabited by 292,880 persons, all of whom adhere to the catholic religion.

JURATS, Jurati, magistrates resembling aldermen, appointed for the government of several corporations. Thus we meet with the mayor and jurats of Maidstone, Rye, Winchelsea. Jersey has also a bailiff, and twelve jurats, or sworn assistants, to govern the island.

JURIEU, Peter, an eminent French protestant divine, called ironically by the Catholics the Goliath of the Protestants, was born in the year 1637. He was educated in England under his maternal uncle Peter du Moulin, and took orders in the English church; but returning to succeed his father as pastor of a reformed congregation at Mer, in the diocese of Blois, he was made professor of divinity and Hebrew at Sedan, where he acquired great reputation. This university being taken from the Protestants, a professorship of divinity was founded for him at Rotterdam; and he was also appointed minister of the Walloon church in the same town. Being now in a place of liberty, he gave full scope to an imagination naturally warm, and applied himself to study the book of Revelation, of which he fancied that he had by a kind of inspiration discovered the true meaning; a notion which led him to form many enthusiastic conjectures. He was, moreover, so unfortunate as to quarrel with his best friends for opposing his visionary opinions, which produced violent disputes with Bayle and De Beauval. He died in 1713; and left a great number of esteemed works, the principal of which are, 1. A Treatise of Devotion; 2. Preservative against Popery, 1673; 3. A Vindication of the Morality of the Protestants against the Accusations of M. Arnauld, 1675, 1685; 4. The last Efforts of Afflicted Innocence; 5. Histoire des Dogmes et des Cultes; 6. Histoire du Calvanisme et du Papisme mise en parallèle, 1683, in three vols.; 7. Lettres Pastorales; 8. Traité de l'Unité de l'Eglise, 1688; 9. Abrégé de l'Histoire du Concile de Trente, 1683; 10. Traite de la Nature et de la Grace; and various other works. Jurieu was unquestionably a man of considerable learning, but he entertained peculiar notions of his own, and showed little toleration for the opinions of others.

JURIN, James, born in 1684, a distinguished person, who cultivated medicine and the mathematics with equal success. He was secretary to the Royal Society of London, as well as president of the College of Physicians there. He had serious disputes with Michelotti upon the momentum of running waters, with Robins upon distinct vision, and with the partisans of Leibnitz upon moving bodies or living forces. A treatise of his upon Vision is printed in Smith's Optics. He died in 1750. Jurin was a warm partisan and an active defender of the practice of inoculation, and, in several publications, established its utility by a comparison of the respective degrees of mortality occasioned by the casual and the inoculated small-pox. He was also editor of Varenius's Geography, published at the request of Newton and Bentley; and in the Works of the Learned for 1737, he carried on a controversy with Dr Pemberton in defence of Newton.

JURISCONSULTUS (contracted *ICtus*) amongst the Romans, was a person learned in the law, a master of the Roman jurisprudence, who was consulted on the interpretation of the laws and customs, and on the difficult points in law-suits. The fifty books of the Digest were compiled wholly from the answers or reports of the ancient jurisconsults; and Tribonian, in destroying the two thousand volumes from which the Code and Digest were compiled, has deprived the public of a world of things which would have thrown light upon the ancient office of the jurisconsults. We should scarcely have known any thing beyond their bare names, had not Pomponius, who lived in the second century, taken care to preserve some circumstances illustrative of their office. The Roman jurisconsults seem to have been nearly the same with our chamber counsellors, who arrived at the honour of being consulted through age and experience, but never pleaded at the bar. The pleading advocates or lawyers never became jurisconsults. In the times of the commonwealth, the advocates had by much the more honourable employment, as being in the ready way to attain the highest preferments. They then despised the jurisconsults, calling them in derision *formularii* and *legulei*, as having invented certain forms and monosyllables, in order to give their answers the greater appearance of gravity and mystery. But in process of time the latter became so much esteemed that they were called *prudentes* and *sapientes;* the judges were appointed to follow their advice; and Augustus advanced them to be public officers of the empire. Rutilius has written the lives of the most famous jurisconsults.

JURISPRUDENCE.

I.—The object of the science which is distinguished by the name of Jurisprudence, is the protection of rights.

The end of jurisprudence.

The business of the present discourse is, therefore, to ascertain the means which are best calculated for the attainment of that end.

What we desire to accomplish is, the protection of rights: What we have to inquire is, the means by which protection may be afforded.

Importance of the inquiry.

That rights have hitherto been very ill protected, even in the most enlightened countries, is matter of universal acknowledgment and complaint. That men are susceptible of happiness only in proportion as rights are protected, is a proposition which, taken generally, it is unnecessary to prove. The importance of the inquiry, therefore, is evident.

Confusion in the vulgar uses of the word right.

It is requisite, as a preliminary, to fix, with some precision, what we denote by the expression *rights.* There is much confusion in the use of this term. That disorderly mass, the Roman law, changes the meaning of the word in stating its division of the subject, *Jura Personarum* and *Jura Rerum.* In the first of these phrases, the word *Jura* means a title to enjoy; in the second, it must of necessity mean something else, because things cannot enjoy. Lawyers, whose nature it is to trudge one after another in the track which has been made for them, and to whose eyes that which is and that which ought to be have seldom any mark of distinction, have translated the jargon into English, as well as into other modern languages.

This is not all the confusion which has been incurred in the use of the word *right.* It is sometimes employed in a very general way, to denote whatever ought to be; and in that sense is opposed to wrong. There are also persons, but these are philosophers, pushing on their abstractions, who go beyond the sense in which it is made to denote generally whatever ought to be, and who make it stand for the *foundation* of whatever ought to be. These philosophers say that there is a right and a wrong, original, fundamental; and that things ought to be, or ought not to be, according as they do, or do not, conform to that standard. If asked whence we derive a knowledge

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of this right and wrong in the abstract, which is the foundation and standard of what we call right and wrong in the concrete, they speak dogmatically, and convey no clear ideas.[1] In short, writers of this stamp give us to understand that we must take this standard, like many other things which they have occasion for, upon their word. After all their explanations are given, this, we find, is what alone we are required, or rather commanded, to trust to. The standard exists. Why? Because they say it exists; and it is at our peril if we refuse to admit the assertion. They assume a right, like other despots, to inflict punishment for contumacy, or contempt of court. To be sure, hard words are the only instruments of tyranny which they have it in their power to employ. They employ them accordingly; and there is scarcely an epithet calculated to denote a vicious state of the intellectual or moral part of the human mind, which they do not employ to excite an unfavourable opinion of those who refuse subscription to their articles of faith.

...e of the ...m right.

With right, however, in this acceptation, we have at present no farther concern than to distinguish it clearly from that sense in which the word is employed in the science of jurisprudence. To conceive more exactly the sense in which it is employed in that science, it is necessary to revert to what we established in the article GOVERNMENT, with regard to the end or object of the social union; for to that every thing which is done in subservience to the social union must of course bear a reference.

In that article it appeared, that as every man desires to have for himself as many good things as possible, and as there is not a sufficiency of good things for all, the strong, if left to themselves, would take from the weak every thing, or at least as much as they pleased; that the weak, therefore, who are the greater number, have an interest in conspiring to protect themselves against the strong. It also appeared, that almost all the things which man denominates good are the fruit of human labour, and that the natural motive to labour is the enjoyment of its fruits.

That the object, then, of the social union may be obtained; in other words, that the weak may not be deprived of their share of good things, it is necessary to fix, by some determination, what shall belong to each, and to make choice of certain marks by which the share of each may be distinguished. This is the origin of right. It is created by this sort of determination, which determination is either the act of the whole society, or of some part of the society which possesses the power of determining for the whole. Right, therefore, is factitious, and the creature of will. It exists only because the society, or those who wield the powers of the society, will that it should exist; and before it was so willed it had no existence.

It is easy to see what is the standard, in conformity with which the rights in question *ought* to be constituted; meaning by *ought*, that which perfect benevolence would desire. It is the greatest happiness of the greatest number. But whether rights are constituted, that is, whether the shares of good things are allotted to each, according to this standard, or not according to this standard, the allotment is still the act of the ruling power of the community; and the rights about which the science of jurisprudence treats have this alone for the cause of their existence.

...e principal ideas ...olved in ... jurisprudential ...se of ... word.

In this complicated term it is obvious that there is involved, on the one hand, the idea of the person to whom a share is allotted, and on the other hand, an idea of the things which are allotted. The one is the owner of the right, the person to whom it belongs; the other is the object of the right, namely, the person or thing over which certain powers are given.

All rights respect objects desired.

All rights of course are rights to objects of human desire, of nothing else need shares be allotted. All objects which men desire, are desired either as the end or as means. The pleasurable state of the mind is the end, consisting of the feelings of the mind. It would be absurd, however, to speak of giving a man a right to the feelings of his own mind. The objects of desire, therefore, which are the objects of right, are not the pleasurable feelings themselves, which are desired as the end, but the objects which are desired as the means to that end.

The objects of rights are twofold.

Objects of desire, as means to that end, may be divided into the class of persons and the class of things. Both may be the object of rights. In framing our language, therefore, we may say that all rights are the rights *of* persons; but they may be rights *to* either persons or things.

Rights mean legalized powers.

All that men desire, either with persons or things, is to render them subservient to the end for which they are desired as means. They are so rendered by certain powers over them. All rights, then, when the term is closely investigated, are found to mean powers; powers with respect to persons, and powers with respect to things. What any one means when he says that a thing is his property, is, that he has the power of using it in a certain way.

It is no part of the present inquiry to ascertain what rights *ought* to be constituted, or what rights perfect benevolence would choose to see constituted. That belongs to the question, how government should be constituted; in other words, how the powers which are necessary for the general protection ought to be distributed, and the advantages of the union to be shared. At present, our sole endeavour is to ascertain the most effectual means which the governing power of the state can employ for protecting the rights, whatever they are, which it has seen meet to create.

Every right imports a corresponding obligation.

Rights, it must be remembered, always import obligations. This is a point of view which, in the consideration of rights, has not in general attracted sufficient attention. If one man obtains a right to the services of another man, an obligation is, at the same time, laid upon this other to render those services. If a right is conferred upon one man to use and dispose of a horse, an obligation is laid upon other men to abstain from using him. It thus appears that it is wholly impossible to create a right without at the same time creating an obligation.

No creation of good by rights without the creation of evil.

The consequences of this law of nature are in the highest degree important. Every right is a benefit; a command to a certain extent over the objects of desire. Every obligation is a burden; an interdiction from the objects of desire. The one is in itself a good, the other is in itself an evil. It would be desirable to increase the good as much as possible. But, by increasing the good, it necessarily happens that we increase the evil. And if there be a certain point at which the evil begins to increase faster than the good, beyond that point all creation of rights is hostile to human welfare.

The end in view is a command over the objects of desire. If no rights are established, there is a general scramble, and every man seizes what he can. A man gets so much, and he is interdicted by the scramble from all the rest. If rights are established, he also gets so much, and is interdicted by his obligations from the rest. If what he obtains by his rights exceeds what he would have obtained by the scramble, he is a gainer by the obligations which he sustains.

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[1] See the writings of Kant and his followers, *passim*. See also Degerando, and others of his school, in various parts of their works.

If it is proposed to create rights in favour of all the members of a community, the limits are strict. You cannot give all your advantages to every one; you must share them out. If you do not give equal rights to all, you can only give more than an equal share to some, by diminishing the share of others, of whom, while you diminish the rights, you increase the obligations. This is the course which bad governments pursue; they increase the rights of the few, and diminish the rights of the many, till, in the case of governments virtually despotic, it is all right on the one side, all obligation on the other.

It may be necessary to say a word to prevent misconstruction of the term "equal rights." Rights may truly be considered as equal, when all the sorts of obligation under which a man lies with respect to other men, they are placed under with respect to him; if all the abstinence which he is obliged to practise with respect to their property, they are obliged to practise with respect to his; if all the rules by which he is bound not to interfere with their actions, bind them equally not to interfere with his. It is evident, that inequality of fortune is not excluded by equality of rights. It is also evident, that from equality of rights must always be excepted those who are intrusted with the powers of the community for the purposes of government. They have peculiar rights, and the rest of the community are under corresponding obligations. It is equally evident that those must be excepted who are not *sui juris*, as children in non-age, who must be under the guidance of others. Of two such classes of persons, the relation to one another, that is, their reciprocal rights and obligations, need to be regulated by particular rules.

It is presumed that these illustrations will suffice to fix, in the minds of our readers, the exact meaning which is intended, in the present discourse, to be attached to the word *rights*. The sequel is to be occupied in discovering the means which are most proper to be employed for affording *protection* to those rights.

Meaning of the word protection, in the jurisprudential phrase, protection of rights.

II.—In the term protection, it is hardly necessary to give notice, that we do not here include protection against foreign enemies; that protection which is to be yielded by employing armies against invaders. The protection of which it is the business of jurisprudence to find out and to describe the means, is that which is required by one member of the community against the other members. The members of the community, each of whom endeavours to have as much as possible of the objects of desire, will be disposed to take those objects one from another; to take them either by force or by fraud. The means of preservation must therefore be found. Certain members of the community, as organs of government, are furnished with powers for that purpose. The question is, what powers are required, and in what manner are they to be employed?

In proceeding to present what may be called a skeleton map of the ill-explored country of jurisprudence, it is necessary to warn the reader, that he must supply, by his own attention, what the limits of the work did not permit to be done for him. The several topics are rather indicated than expounded. It is hoped they are indicated so clearly that there will be no difficulty in spreading out the ideas in detail. It is necessary, however, that the reader should do this for himself. As the writer has not been able to dwell upon the several topics, though of the utmost importance, long enough to stamp the due impression of them upon the mind, unless the reader takes time to do this, by reflection on each topic, as it arrives, he will pass to the succeeding ones without due preparation, and the whole will be perused without interest and without profit.

The first requisite to the protection of rights.

That a man's rights may be effectually secured, it is obviously necessary, in the first place, that they should be made capable of being accurately known. This seems to be so undeniable, that it would answer little purpose to enlarge in its illustration. It is, however, exceedingly necessary that the importance of this requisite should be clearly and adequately conceived. How can a man's rights be protected from encroachment, if what are his rights be uncertain or unknown? If the boundary by which his rights are distinguished is clear and conspicuous, it is itself a protection. It warns off invaders; it serves to strike them with awe; for it directs the eyes and indignation of mankind immediately and certainly to the offender. Where the boundary, on the other hand, is obscure and uncertain, so far scope is allowed for encroachment and invasion. When the question, to which of two men an article of property belongs, comes for decision to the judge, it is easy, if accurate marks are affixed, to point out and determine the rights of each. If no marks are attached, or such only as are obscure and variable, the decision must be arbitrary and uncertain. To that extent the benefit derived from the creation and existence of rights is diminished.

Definition of rights the first instrument of protection.

It is therefore demonstrable, and we may say demonstrated (the demonstration not being difficult), that in the inquiry respecting the means of protecting rights, the *definition of rights* may be entered at the head of the list. Without this as the groundwork, all other means are ineffectual. In proportion as rights can be ascertained, are the judicial functions and judicial apparatus capable of being employed to any beneficial purpose. In proportion to the facility with which they can be ascertained, is the extent of the benefit which the judicial functions are enabled to secure.

Such, then, is the first of the means necessary for the protection of rights. That they may receive the most perfect possible protection, they must be as accurately as possible defined.

Definition of the acts by which rights are violated, &c. another instrument of protection.

In supposing that rights have need of protection, we suppose that there are acts by which rights are violated. With regard to those acts, the object is twofold; to redress the evil of the act when it has taken place, and to prevent the performance of such acts in future. To prevent the performance, two classes of means present themselves; to watch till the act is about to be committed, and then to interpose; or to create motives which shall prevent the will to commit. It is but a small number of cases in which the first can be done; the latter is, therefore, the grand desideratum. From the view of these circumstances, we discover two other articles in the catalogue of means. Those acts by which rights are violated require to be made accurately known; in other words, to be defined; and the motives which are fitted to prevent them must be duly applied. Motives sufficient to that end can only be found in the painful class; and the act by which they are applied is denominated punishment. The definition, therefore, of offences, or of the acts by which rights are violated, and which it is expedient to punish, and the definition of the penalties by which they are prevented, are equally necessary with the definition of rights themselves. The reasons which demonstrate this necessity are so nearly the same with those which demonstrate the necessity of the definition of rights, that we deem it superfluous to repeat them.

Civil and penal code—what.

The definition of rights constitutes that part of law which has been generally denominated the *civil code*. The definition of offences and punishments constitutes that other part of law which has been generally denominated the criminal or *penal code*.

Code of procedure—what.

When rights are distributed, and the acts by which they may be violated are forbidden, an agency is required, by which that distribution may be maintained, and the violators of it punished. That agency is denominated judicature. The powers by which this agency is constituted require to be accurately defined, and the mode in which the agency itself is to be carried on must be fixed and pointed out by clear and determinate rules. These rules and definitions prescribe the form and practice of the courts, or mode in which the judicial functions are performed; and constitute that branch of law which has been called the *code of procedure.*

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These three codes, the civil code, the penal code, and code of procedure, form together the whole subject of jurisprudence. Of the three, it sufficiently appears that the last exists only for the sake of the other two. Courts and their operations are provided, that the provisions of the civil and penal codes may not be without their effect. It is to be considered, therefore, as subordinate, and merely instrumental, in respect to the other two. They form the main body of the law; this is an accessary to the main body, though an accessary of indispensable use. It would be of great advantage to affix characteristic names to distinguish from one another the main and accessary parts of law. Unexceptionable names, however, it is not easy to find. Mr Bentham, the great improver of this branch of knowledge, has called the civil and penal codes together by the name of "substantive law," the code of procedure by that of "adjective law;" not, we may be satisfied, because he approved of those names, but because the language hardly afforded others to which equal objections would not apply. In the very sense in which either the term accessary or the term adjective can be applied to the code of procedure, both may be applied to the penal code, as it respects the civil. The penal code exists purely for the sake of the civil, that the rights which are ordained by the legislature, and marked out by the terms of the code, may be saved from infringement. The civil code is therefore the end and object of all the rest. The code of procedure, however, is auxiliary to each of the other two; the penal code to no more than one.

Having now explained the nature of the three codes which constitute the body of law necessary for the protection of rights, it remains that we illustrate, as much in detail as our limits will permit, what is required for the perfection of each.

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III.—The grand object of the civil code is the definition of rights. Rights are sometimes more, sometimes less extensive. Thus the right of a man to a horse may solely extend to use him in riding from one stage to another; or it may extend to the power of doing with him as he pleases. In like manner, the rights of a man with respect to a person may extend only to some momentary service, or they may go the length of slavery. Even slavery itself does not imply rights always equally extensive. In some cases it implies rights as extensive over the slave as over the inferior animals.

All rights, when the essence of them is spoken of, are powers; powers to an individual which the governing members of the community guarantee; powers, more or less extensive, of making either a person or a thing subservient to the gratification of his desires. To be made to gratify the desire of an individual, is to be made to render him a *service.* And the term *service* may, fortunately, be applied to both persons and things. A man receives a service from the field when it produces a crop, as well as from the servant and the horse who ploughed it. In one meaning of the word service, it implies only active service, or that rendered by the voluntary operations of sentient beings. In the present case, however, it is employed to denote both active and passive services. It is evident, that in every case in which any thing inanimate is rendered subservient to the gratification of a desire, the service is, properly speaking, a passive service. It is also evident, that even animate beings are rendered subservient to the gratification of desires in a way which may equally be called passive.

It is necessary to request attention to the explanation which is here given of the meaning in which the term *service* is to be employed; as both the English and the Roman lawyers use it in a very restricted sense. Here it is employed to denote the whole of that ministration to the gratification of our desires, which we are entitled, in consequence of rights, to derive either from persons or from things. Rights are powers, and the powers are means for the obtaining of services. We have now, therefore, a language, by the help of which we may speak with tolerable clearness.

Our object is to define rights, and rights are powers. But these powers can be defined, only by a reference to the services which they are the means of obtaining.

Operations preliminary to the definition of rights.

The first thing, therefore, to be done for the definition of rights is, to make out a list of all the kinds of services which the legislature permits an individual to derive, first, from persons, and secondly, from things. This would not be a matter of very great difficulty. It would be right to begin with the most simple cases, and go on to the more complex. Thus, of the services derivable from a person, some are limited to a single species of act, and that within a limited time, and at a particular place. Others are services, consisting of various acts, limited or not limited in space and time. And, lastly, are the whole services which a man is capable of rendering, without limitation as to either space or time. Considerable pains would be necessary to make the list complete; and not only considerable pains, but considerable logic, would be necessary to classify the services, in other words, make them up into lots, the most convenient for the purpose in question, and to fix the extent of each by an exact definition. It is obvious, that as soon as all the possible gradations in the services which one human being can render to another, are exhibited by such enumeration and assortment, it is easy for the legislature to point out exactly whatever portion of these services it is its will to give any individual a right to.

The same considerations apply to the class of things. In being made subservient to the gratification of our desires, they also render services. In proportion as a man has the right to derive those services from them, they are said to be his property. The whole of the services which are capable of being derived from them may, without much difficulty, be enumerated and classified; and when they are so, those which it may be the pleasure of the legislature to make any one's property may be very easily and distinctly pointed out.

We may take land for an example. All the different services which are capable of being derived from the land may be enumerated, and, being classed under convenient heads, may be referred to with perfect certainty; and any portion of them which is made the property of any individual may thus be accurately described. A man may have a right simply to pasture a field; to pasture it for a day, or a year, or a hundred years. He may have a right to crop it; and that either in a particular manner, or in any manner he pleases, for a year, or for any other time. He may have a right to use it for any purpose, and that during a limited time, or an unlimited time. The services which it is capable of rendering may belong to him in common with a number of other persons, or they may all belong to himself.

In illustration of this subject we may notice a classification of the services derivable from the land, made, though very rudely, by the English law. Blackstone, who, like other English lawyers, has on this, as on all other occasions, no idea of any other classification than that which is made by the technical terms of the English law, has distinguished certain lots of the services derivable from the land, under the name of "estates therein; estates with respect to, 1*st*, quantity of interest; 2*dly*, time of enjoyment; 3*dly*, number and connection of the tenants." That is, estates in fee simple, comprehending the whole of the services which are capable of being derived from the land, unlimited in point of time; estates in fee tail, implying always limitation in point of time, and often a limitation in respect to some of the services; estates for years; estates at will; estates at sufferance; estates on condition; estates in remainder; estates in reversion; estates in jointenancy; estates in coparcenary; estates in common. The Roman law has made no enumeration or classification of the services derivable from any thing, not even from the land. It speaks of property in the abstract, and in two states; property in possession, and property in action. The English law does the same thing in regard to all other property but the land. "Property, in chattels personal, is either in possession or in action," says Blackstone. He does, indeed, add, "the property of chattels personal is liable to remainders, if created by will, to jointenancy, and to tenancy in common."

The services derivable from other articles of property than land, need not be divided under many heads. A piece of plate, for example, may render certain services without alteration of its form; it may be incapable of rendering other services till it has received an alteration of its form. It is chiefly, therefore, by limitation of time, that the various quantities of interest in such articles need to be determined. A man's right may extend to the use of a silver cup, for a day, or a year, or for his life. During this time the different services which it is capable of rendering have no occasion to be divided. They go naturally altogether. An unlimited right to its services implies the power of using it, either with or without alteration of its form, and without limitation of time. In most instances the limited right would be called loan, though, in the case of heir-looms and some others, there is a limited use to which the term loan is not customarily applied.

In speaking of the rights which a man may have to persons; as master, as father, as husband, and so on, there is one case so remarkable, that it requires a few words to be added in its explanation. It is that of one's own person. In this case the rights of the individual have no proper limitation beyond the obligations under which he is laid, in consequence either of the rights conferred upon others, or of the means which are thought necessary for protecting them.

If we have enabled our readers to form a tolerable conception of what we desire to be accomplished, under the title of an enumeration and commodious classification of the services derivable from persons and things, we have performed what we proposed. The enumeration and classification themselves are evidently incommensurate with the design of an article in the present work. That they are practicable may be confidently taken for granted. In fact, they amount to nothing more than a description of the different degrees in which the property of a thing may be possessed; a point which is decided upon in every legal dispute. If this be done from time to time, for one article after another, it may be done once for all.

We have already said, that rights are powers, powers for the obtaining of certain services. We have also said, that those powers can be defined only by a reference to the services which they are the means of obtaining. When those services are enumerated and classified, what remains is easy. A right to those services must begin, and it may end. The legislature has only to determine what fact shall be considered as giving a beginning to each right, and what shall be considered as putting an end to it, and then the whole business is accomplished.

Two things necessary for the definition of a right.

It is evident that, for the definition of rights, two things are necessary. The first is, an exact description of the extent of the right; the second is, the description of the fact which gives birth to it. The extent of the right is described by reference to the lots of services, in the title to which services all rights consist. The facts which the convenient enjoyment of rights has pointed out as the fittest for giving commencement to rights, have been pretty well ascertained from the earliest period of society; and there has, in fact, been a very great conformity with respect to them in the laws of all nations.

The following is an imperfect enumeration of them: *An expression of the will of the legislature,* when it makes any disposition with regard to property; *occupancy,* when a man takes what belongs to nobody; *labour; donation; contract; succession.* Of these six causes of the commencement of a right, there is a remarkable distinction between the first three and the last three. The first three give commencement to a right in favour of one individual, without necessarily putting an end to a right enjoyed by any other individual. The last three give commencement to a right in favour of one individual, only by making the same right to cease in favour of another individual. When a man, by donation, gives a horse to another man, the horse ceases to be the property of the one man, by the very same act by which he becomes the property of the other; so in the case of sale, or any other contract.

It is necessary for the legislature, in order that each man may know what are the objects of desire which he may enjoy, to fix, not only what are the facts which shall give commencement to a right, but what are the facts which shall put an end to it. In respect to these facts, also, there is a great harmony in the laws of all nations.

There is first the will of the legislature. When it confers a right, it may confer it either for a limited or for an unlimited time. In the term unlimited time, we include the power of tradition, or transfer, in all its shapes. If the time is limited, by the declaration of the legislature, either to a certain number of years, or the life of the party, the fact which terminates the right is obvious. If a man possesses a right unlimited in point of time, the events are three by which it has been commonly fixed that it may be terminated: 1. some expression of his own will, in the way of gift or contract; 2. some act of delinquency; or, 3. his death.

The possessor of a right unlimited in point of time, may, in the way of gift or contract, transfer his right either for a limited or for an unlimited time. Thus the owner of a piece of land may lease it for a term of years. He may also, in this way, convey the whole of the services which it is capable of rendering, or only a part of them. In this transaction, one event gives birth to a right in favour of the man who receives the lease, and terminates a right which was possessed by the man who gives it; another event, namely, the arrival of the period assigned for the termination of the lease, terminates the right of the man who had received the lease, and revives the former right of the man who gave it.

Acts of delinquency have been made to terminate rights, by the laws of most nations, in the various modes of forfeiture and pecuniary penalty.

The mode in which the event of death should terminate rights has been variously regulated. Sometimes it has been allowed to terminate them simply; and what a man left at his death was open to the first occupant. All but rude nations, however, have determined the persons to whom the rights which a man possessed without limitation of time, shall pass at his death. The will of the former owner, when expressed, is commonly allowed to settle the matter. When that is not expressed, it has by most legislators been regulated that his rights shall pass to his next of kin.

What is the extent of each right, by what event it shall receive its commencement, and by what event it shall be terminated; this is all which is necessary to be predetermined with respect to it. To do this is the duty of the legislature. When this is done, the inquiry of the judge is clear and simple. Does such a right belong to such a man? This question always resolves itself into two others. Did any of the events which give commencement to a right happen in this case? And did any of those events which terminate a right not happen in this case? These are questions of fact as distinguished from law, and are to be determined by the production of evidence. If a man proves that an event which gives commencement to a right happened in his case, and if another man cannot prove that an event which terminates a right happened subsequently in that case, the right of the first man is established.

If we have now ascertained the importance and practicability of a civil code, and have shown what is to be done in order to obtain the benefit of it, we shall conclude, with some confidence, that we have rendered a great service to mankind. We proceed to the consideration of the penal code. The object of that code is, the acts by which rights may be violated.

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IV.—In the term violation, we include all those acts by which the powers conveyed by a right are prevented from operating according to the will of the owner.

With respect to a part of such acts, all that it is found convenient to do, through the instrumentality of judicature, is, to remove the obstruction which prevents the enjoyment of the right, without inflicting any penalty for creating it. Thus, if a debt is not paid when due, the right is violated of the man who ought to receive it. Enough, however, is in this case supposed to be done, if the man who owes the debt is constrained to make payment. The act of secretly abstracting, with a view to appropriate a property of perhaps less value, would be an act which the laws of all nations would punish as theft.

Of injurious acts, those alone to the commission of which it has been deemed expedient that penalties should be annexed, are considered as the object of the penal code. Of injurious acts so perfect an analysis has been exhibited by Mr Bentham; so perfectly, too, have the grounds been laid down upon which those acts which are destined for punishment should be selected from the rest; and so accurately have the principles according to which punishment should be meted out been displayed by that great philosopher, that, on this part of the subject, the philosophy of law is not far from complete.

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As acts are declared to be offences, and are made subject to punishment solely for the protection of rights, it is evident that all acts which enter into the penal code are acts which infringe rights, either directly or indirectly. Those which infringe them *directly*, are those by which injury is done to some individual or individuals; a blow, for example, an act of theft, and so on. We include also, under this division, all acts the *effects* of which produce an immediate infringement of rights; destroying a mound, for example, to inundate the lands of another man; importation of infection, by which the health or lives of others may be destroyed. Those acts by means of which rights are affected *indirectly*, are those which bear immediately upon the means which the state has provided for the protection of rights. The means which the state has provided for the protection of rights are the operations of government generally. All acts, therefore, meet for punishment, are acts which disturb either individuals in the enjoyment of their rights, or the operations required for the protection of those rights. The latter, though mediately, and not immediately, hurtful, are apt to be more extensively mischievous than the former. An act which infringes upon a right immediately, is commonly injurious only to one individual, or a small number of individuals; an act which prevents any of the operations of government from proceeding in its natural course, is injurious to all those individuals to whose protection the due course of that operation is useful. Permit acts which interrupt all the operations of government, and all rights are practically destroyed.

If, as it thus appears, acts are meet for punishment, only because they infringe a right, or because they interrupt the operations provided for the protection of rights, it is evident, that, in the definition of one set of those acts, must be included the specification of the right which is infringed; and, in the definition of the other, must be included the specification of the operation disturbed. Before, therefore, an accurate penal code can exist, there must exist an accurate civil code, and also what we may call a constitutional or political code; the latter consisting of an accurate definition of the powers created for the purposes of government, and of the limitations applied to their exercise.

What is required to the definition of an offence.

From what has been said, it may appear that the definition of offences, by which name we shall hereafter distinguish punishable acts, consists necessarily of two parts. The first part is the specification of the right infringed, or the operation of government disturbed; and the second part is the definition of the mode. Thus, for the definition of an act of theft, the right which the act has violated must be distinctly marked, and also the mode in which the violation has been committed. In one and the same class of offences, those against property, for example, the mode in which the violation is performed, is that chiefly which constitutes the difference between one offence and another. In a theft and a robbery, the right violated may be exactly the same; the mode in which the violation was effected constitutes the difference.

For several purposes of the penal code, it is useful, that, in the specification of the right violated, the value of what has been violated, in other words, the amount of the evil sustained, should sometimes be included. It is evident that the value of rights can be judged of ultimately, only by a reference to human feelings. Of these feelings, however, certain outward marks must be taken as the standard. In offences which concern property, the modes of valuation are familiarly known. In injuries to the person, those marks which denote injuries regarded by mankind in general as differing in magnitude; the size, for example, or position, of a wound; in injuries to reputation, the words used, and the occasion when, and so forth, are the only means of distinction which can be employed.

It may be necessary also to remark, that, in that part of the definition which relates to the mode, are to be distinguished the parties, when more than one, who engage in the same offence with different degrees of criminality; meaning, by different degrees of criminality, nothing more than demand for different degrees of punishment. The chief classes of such persons are those of principals and accessaries; and of accessaries, both those before and those after the fact.

In the definition of the mode, the act is first to be described in its ordinary shape. The act, however, may be attended with aggravating circumstances on the one hand, or extenuating circumstances on the other; presenting a demand for increased punishment in the first case, and diminished punishment in the second. Mr Bentham has logically remarked, that the circumstances which are to be regarded as aggravating, and the circumstances which are to be regarded as extenuating, being pretty nearly the same in all cases, they may be defined, in a separate chapter, once for all. This being done, the code proceeds in the following manner:—The definition is given of the offence in its ordinary shape, and the appropriate punishment is annexed; then immediately follows the same offence with aggravating circumstances; punishment so much the more severe: the same offence with extenuating circumstances; punishment so much the less.

Thus far we have spoken of the definition of offences, into which we have entered the less in detail, because we do not think there is much of controversy on the subject. Many persons, who doubt the possibility of framing a civil code, though, after the preceding exposition of the subject, it is a doubt which could not, we should imagine, very easily maintain itself, allow that offences may all be defined; and that it is possible to prevent the monstrous iniquity of punishing men for acts, as offences, which they have not the means of knowing to be such.

The doctrine of punishment.

V.—After offences, comes the consideration of the punishment to be annexed to them. This is a subject of considerable detail; it has been, however, so fully and admirably treated by Mr Bentham, that only some of the more general considerations, necessary to mark out the place and importance of the topic, need here to be introduced.

When a right has been infringed, there are two things, it is evident, which ought to be done: the injury which has been sustained by the individual ought to be repaired, and means ought to be taken to prevent the occurrence of a like evil in future.

Satisfaction.

The doctrine of satisfaction is not at all difficult, as far as regards the regulating principles; the complication is all in the detail. The greater number of injuries are those which concern property. A pecuniary value can generally be set upon injuries of this sort, though it is not very easy to determine the *pretium affectionis*, a matter of considerable importance, which the English law, so much made up of clumsiness in one part, and false refinement in another, wholly overlooks. For injuries to the person, also, it is most frequently in the pecuniary shape alone that any compensation can be made. In making these estimates, some general marks are all that can be conveniently defined by the law, and a considerable discretion must be left to the judge. Indeed, the question of damages is always a question of fact, which must be determined by the evidence adduced in each instance.

It accords with the feelings of every man to say, that he who has committed an injury should be made to repair it. One part of punishment, therefore, ought, wherever special reason does not intervene, to consist in making satisfaction to the party injured. Pecuniary satisfaction, where the delinquent is rich, may be a small part of the due punishment; still, however, there is an obvious propriety in making it a part so far as it can go. In the cases in which the delinquent has no property, there is the same propriety in making his labour subservient to that end. Hard labour, with the most economical fare, till the produce of the labour equals the amount of the satisfaction required, is therefore a species of punishment recommended by the strongest considerations. It is not said that labour so limited would always be sufficient punishment, and there are many cases in which it would be too much; but even then it should go as far as it can in the one case, and as far as it ought in the other.

When the injury is done to reputation, there is a manifest propriety in making the injurer contribute to the reparation, wherever it can be done. In many of the cases, too, the proper mode is abundantly obvious; all those, for example, where the publication of falsehood is the injurious act. The author of the injury may be obliged to declare, in a way as public as that of the offence, and as well calculated as possible for the reparation of the injury, that he has been solemnly adjudged to have propagated a falsehood, and is condemned to publish his own shame.

In the case of those offences which affect rights indirectly, namely, by affecting the securities provided for them, satisfaction seldom can have any place, because no determinate individual or individuals have sustained an injury.

This may suffice in exposition of the first thing which is desirable where an injury has been committed; namely, that reparation should be made. The second is, that measures should be adopted for preventing the future occurrence of similar events.

Penalties.

Acts are performed only because there are motives to the performance of them. Of course injurious acts are performed only because there are motives to the performance of them.

Corporal restraint being out of the question where all the members of the community are concerned, it is evident that only two means remain for preventing injurious acts; either, first, to take away the motives which provoke to them; or, secondly, to apply motives sufficient for the prevention of them.

From the very nature of many of the acts, it is impossible to take away the motives which provoke to them. From property stolen it is impossible to detach the value of the property; from vengeance it is impossible to detach the hope of that relief which is sought by the blow that is aimed.

What is wanted, then, is a sufficiency of motive in each instance to counteract the motives which lead to the crime. Whatever the motives of the alluring kind which lead to an act, if you give stronger motives of the same kind to abstain from the act, the act will of course be prevented. The man who would steal from you L.5, will assuredly not do so if he knows that he shall receive L.6 for abstaining.

The question may then be started, Why should not all crimes be prevented in this way, since reward is much more desirable and humane than punishment? The answer is most satisfactory, and is built upon a ground which ought to receive profound attention on many occasions on which it is treated with the most perfect disregard. No reward can be given to one man or set of men, but at the expense of some man or set of men. What is reward to one, is therefore punishment to others. If L.6 be given to the man who would steal L.5, it must be taken from some one or more individuals of the community. If one man is elevated by any title or distinction, all the rest, with regard to him, are degraded and depressed. This is utterly unavoidable. The one event is necessarily included in the other. The giving of rewards, therefore, is a matter of serious import. It is not that simple act, that pure creation of good, which it is often so fraudulently given out to be, and so credulously and foolishly admitted to be.

Other reasons, which prove the insufficiency of rewards for preventing injurious acts, are too obvious to require to be mentioned. We shall not therefore dwell upon this topic. This at least is sufficiently evident, that, to counteract the motives which lead to the commission of an act, we have but two methods. If we cannot apply motives of the pleasurable sort to induce the party to abstain from committing the act, we must apply such motives of the painful sort as will outweigh the motives which prompt to the performance. To prevent, by such means, a theft of L.5, it is absolutely necessary to affix to that act a degree of punishment which shall outweigh the advantage of possessing L.5.

We have now, it is evident, obtained the principle by which punishment ought to be regulated. We desire to prevent certain acts. That is our end, and the whole of our end. We shall assuredly prevent any acts, if we attach to them motives of the painful kind, sufficient to outweigh the motives of the opposite kind which lead to the performance. If we apply a less quantity of evil than is sufficient for outweighing those motives, the act will still be performed, and the evil will be inflicted to no purpose; it will be so much suffering in waste. If we apply a greater quantity of evil than is necessary, we incur a similar inconvenience; we create a quantity of evil which is absolutely useless; the act which it is the tendency of the motives of the pleasurable kind to produce, will be prevented, if the motives of the painful kind outweigh them in the smallest degree, as certainly as if it outweigh them to any degree whatsoever. As soon, therefore, as the legislator has reached that point, he ought immediately to stop. Every atom of punishment which goes beyond, is so much uncompensated evil, so much human misery created without any corresponding good. It is pure unmingled mischief.

As no exact measure, indeed, can be taken of the quantity of pain which will outweigh a supposed quantity of pleasure, it is sometimes necessary to risk going somewhat beyond the mark, in order to make sure of not falling short of it. And, in the case of acts of which the evil is very great, of the higher order of crimes, in short, it may be expedient to risk a considerable degree of excess in order to make sure of reaching the point of efficiency.

In estimating the quantity of evil which it may be necessary to create, in order to compensate the motive which leads to a mischievous act, two circumstances should be taken into the account. These are certainty and proximity. It is of the less importance here to enter far into the illustration of these topics, that they are now pretty generally understood. It is well known that the prospect of an evil which is to happen within an hour, or two hours, produces a much greater uneasiness than the prospect of the very same evil removed to the distance of years. Every man knows that he will die within a certain number of years; many are aware that they cannot live beyond a few years; and this knowledge produces no uneasiness. The effort, on the other hand, which enables a man to behave with tranquillity on the prospect of immediate death, is supposed to be so difficult, that it is this which makes the hero. It is therefore of the greatest importance that punishment should be immediate; because, in that case, a much smaller quantity of evil suffices. It is imperatively required by the laws of benevolence, that, if evil is a necessary means to our end, every expedient should be used to reduce it to the smallest quantity possible. It is cruelty, it belongs only to a malignant nature, to apply evil in a way which demands a quantity of it greater than would otherwise have been required. Suppose a law, that no act of theft should be punished or challenged till twenty years after the commission, or till the life of the thief was supposed to be near its end. It is evident that all punishment in this case, that death, in the greatest torture, would be nearly destitute of power. This is partly the ground of the complaint, of the little efficacy of religious punishment, though dreadful beyond expression in the degree.

The want of certainty is a defect of equal importance. If it is a matter of doubt whether a threatened evil will take place, the imagination is prone to magnify the chance of its not happening; and, by indulgence, magnifies it to such a degree, that the opposite chance at last excites a comparatively feeble influence. This is a remarkable law of human nature, from the influence of which even the most wise and prudent of men are not exempt; and of which the influence is predominant in those inconsiderate minds which are the most apt to give way to the allurements of vice. To illustrate this law, the influence of the religious punishments affords the most instructive of all examples. The punishments themselves go far beyond what the imagination can conceive. It is the complaint of divines, and the observation of all the world, that, with the great body of men, the efficacy of them is exceedingly small. The reason is, that to the want of proximity is added the greatest uncertainty. If a man puts his fingers in the candle, he knows that he will be punished, and immediately, by being burned. If a man commits even a heinous sin, he has no fear of receiving the religious punishment immediately, and he conceives that, in the mercy of his Judge, in repentance and faith, he has a chance of escaping it altogether. This chance his imagination exaggerates, and most men can, in this way, go on sinning with tranquillity, to the end of their days. If all punishments were as certain and immediate as that of putting a finger in the candle, the smallest quantity, it is evident, beyond what would form a counterbalance to the advantage of the forbidden act, would suffice for its prevention. If uncertainty is admitted to any considerable degree, no quantity of evil will suffice. It is a fact which experience has most fully established, and which is now recognised in the most vulgar legislation, that undue severity of punishment runs counter to its end. This it does by increasing uncertainty; because men are indisposed to be the instruments of inflicting evil by which their feelings are lacerated. That legislation, therefore, is bad which does not take measures for the greatest possible degree of proximity and certainty in the punishments which it applies.

The sources are three from which motives of the painful sort, applicable to the purposes of the legislator, are capable of being drawn:—*1st*, The physical; *2dly*, the moral; and, *3dly*, the religious.

I. Pains from the physical source may be communicated to a man through,

1. His person,
2. His connections,
3. His property.

Through his person, they may be communicated in four principal ways,—by death, disablement, restraint and constraint, simple pain.

A man's connections are either public or private; private, as spouse, parent, servant, master, &c.; public, as ruler, subject, teacher, scholar, and so on.

The modes in which a man is punished through his property need no explanation.

II. Pains from the moral source are the pains which are derived from the unfavourable sentiments of mankind. For the strength of the pains derived from this source, we must refer to the writers who have treated of this part of human nature. It is sufficient here to advert to what is universally recognised, that these pains are capable of rising to a height, with which hardly any other pains, incident to our nature, can be compared; that there is a certain degree of unfavourableness in the sentiments of his fellow-creatures, under which hardly any man not below the standard of humanity can endure to live.

The importance of this powerful agency for the prevention of injurious acts is too obvious to need to be illustrated. If sufficiently at command, it would almost supersede the use of other means. It is, therefore, one of the first objects to the legislator to know in what manner he can employ the pains of the popular sanction with the greatest possible effect.

To know how to direct the unfavourable sentiments of mankind, it is necessary to know in as complete, that is, in as comprehensive a way as possible, what it is that gives them birth. Without entering into the metaphysics of the question, it is a sufficient practical answer, for the present purpose, to say, that the unfavourable sentiments of men are excited by everything which hurts them. They love that which gives them pleasure; hate that which gives them pain. Those acts of other men which give them pleasure or save them from pain, acts of beneficence, acts of veracity, and so on, they love. Acts, on the other hand, which give them pain, mendacity, and so on, they hate. These sentiments, when the state of mind is contemplated out of which the acts are supposed to arise, are transformed into approbation and disapprobation, in all their stages and degrees; up to that of the highest veneration, down to that of the deepest abhorrence and contempt.

The unfavourable sentiments which the legislator would excite towards forbidden acts must, therefore, in each man, arise from his conception of the mischievousness of those acts. That conception depends upon three circumstances: *1st*, The view which he himself takes of the act; *2dly*, the view which appears to be taken by other people; *3dly*, every thing which operates to render more or less permanently present to his mind his own and other men's conception of its mischievousness. From these circumstances, the practical rules for applying this great power as an instrument of the legislator for the prevention of mischievous acts are easily deduced. 1. Let the best measures be taken for giving the people a correct view of the mischievousness of the act; and then their unfavourable sentiments will be duly excited. 2. Let proper pains be taken that the people shall know every mischievous act that is committed, and know its author; that so no evil act may, by concealment, escape the punishment which their unfavourable sentiments imply. 3. Let the legislature, as the leading section of the public, make publication of its own unfavourable sentiments; let it brand the act with infamy. 4. Let the same publication of his own unfavourable sentiments be made by the judge in the shape of reprimand and other declarations. 5. The legislature may increase the effect of these declarations, where the case requires it, by symbolical marks; or, 6. by personal exposure. 7. The legislature may so order matters in certain cases, that the mischievous act can be done only through another act already infamous; as when it is more infamous to break a vow to God than to make false declarations to men, a witness may be made to swear that he will tell the truth. 8. As the favourable sentiments of mankind are powerfully excited towards wealth, a man suffers through the popular sanction when his property is so diminished as to lessen his rank.

III. In pointing and proportioning the apprehension of divine punishment, the legislator can do three things:

1. He can declare his own apprehension, and the measure of it, which should be as exactly proportioned as possible to the mischievousness of the acts:

2. He can hire other people to declare similar apprehensions, and to make the most of the means which are available for their propagation:

3. He may discountenance the pointing of religious apprehensions to any acts which are not mischievous; or the pointing of them more strongly to acts which are slightly, than to acts which are deeply mischievous. Whatever power of restraining from mischievous acts may be lodged in religious apprehensions, is commonly misapplied and wasted. It would be worth the cost, therefore, of pretty forcible means to prevent such a misapplication and waste of religious fears.[1]

In drawing from one or more of these sources, a lot of punishment adapted to each particular case, the following properties, desirable in a lot of punishment, ought to be steadily borne in view. Every lot of punishment ought, as much as possible, to be,

1. Susceptible of graduation, so as to be applied in different degrees.

2. Measurable, that the difference of degrees may be duly ascertained.

3. Equable, that is, calculated to operate with the same intensity upon all persons.

4. Such that the thought of the punishment may naturally excite the thought of the crime.

5. Such that the conception of it may be naturally vivid and intense.

6. Public, addressed to the senses.

7. Reformative.

8. Disabling; viz. from crime.

9. Remediable; viz. if afterwards found to be undeserved.

10. Compensative; viz. to the party injured.

11. Productive; viz. to the community, as labour.

Of all the instruments of punishment which have yet occurred to the ingenuity of man, there is none which unites these desirable qualities in anything like an equal degree with the *Panopticon Penitentiary*, as devised and described by Mr Bentham.

One general rule applies in the case of all the lots of punishment. It is this: That the private good which has operated as the motive to the injurious action should, in all possible cases, be cut off, and the expected enjoyment prevented. Where this can be done completely, all the additional punishment necessary is only that which would suffice to compensate the want of certainty and proximity in the act of deprivation; for no man would commit a crime which he was sure he could not profit by; no man would steal, if he knew that the property stolen would that minute be taken from him. The interests which are capable of being promoted by a criminal act may be summed up under the following titles:

1. Money, or money's worth.
2. Power.
3. Revenge.
4. Vanity, emulation.
5. Sensual pleasure, chiefly venereal.
6. Safety in respect to legal punishment.

With respect to four of these interests, viz. money, power, vanity, and safety in respect to legal punishment, the contemplated benefit is capable, in many cases, of being completely intercepted.

In the case in which revenge has operated through the degradation of the party suffering, the evil-doer may be disappointed by re-exaltation of the degraded party.

Sensual pleasure, having been enjoyed, is beyond the reach of this operation.

It is highly worthy of observation, that, among the advantages constituting the motives to crime, those which can be cut off, and from the enjoyment of which the offender can be precluded, constitute by far the most frequent incentives to crime.

[1] Nothing which can in any degree interfere with the rights of conscience, including whatever interpretation any man may put upon the words of Scripture, is here understood. It is the object of the legislator to encourage acts which are useful, prevent acts which are hurtful, to society. But religious hopes and fears are often applied, not to promote acts which are useful, prevent acts which are hurtful, to society; in which way alone they are capable of conducing to the views of the legislator; but to mere ceremonies. And cases are not wanting in which they are applied to produce acts that are hurtful, prevent those that are useful, to society. As far as religious motives are attached to the useful instead of the useless or hurtful objects, society is benefited. It is this benefit which it is recommended to the legislator to pursue.

This must suffice as a summary of what should be said on the mode of applying pain most usefully for the prevention of certain acts. It only remains to add, that the following are the cases in which it may be pronounced unfit that pain should be employed for that purpose:

1. Where the evil to the community does not overbalance the good to the individual.

2. Where the evil necessary for the punishment would outweigh the evil of the act.

3. Where the evil created is not calculated to prevent the act.

4. Where the end could be obtained by other means.

The code of procedure.

VII.—We have now, therefore, stated what the limits of this discourse enable us to adduce on the subject of the main body of the law; the enactments of the legislature with respect to rights, and with respect to those acts by which rights are violated. It remains that we consider that subsidiary branch of law, by which an agency is constituted for the purpose of carrying those enactments into effect. The inquiry here is, 1. what are the operations essential to that agency; 2. by what agents are they most likely to be well performed; and, 3. what are the best securities that can be taken for the good conduct of those agents.

It most significantly illustrates the manner in which ignorance gropes its way in the dark, to observe that the agency, the sole end of which is to carry into execution the civil and penal laws, was created first, and was in operation for ages, before the idea of the other branches of law was even tolerably framed. It is also worthy of remark, that the men whose wisdom rules our affairs, are in the habit of calling the mode in which ignorance gropes its way in the dark, by the name of experience; the mode of acting upon a plan, and with forethought, by the names of theory and speculation.

There is instruction in observing the mode in which this inverted course of law-making was pursued. Men disputed; and their disputes were attended with the most destructive consequences. Originally, the king, at the head of the military force, and his subordinates, each at the head of a section of that force, interfered in those disputes. After a time, the king appointed functionaries, under the name of judges, for that particular service. Those judges decided, without any rule, by their own discretion. The feelings of the community, grounded upon their experience of what tended to good and evil upon the whole, pointed vaguely to certain things as right, to other things as wrong; and to these the judge, as often as he was *bona fide*, conformed his decision. The mode was similar both in arbitrating and in punishing.

As punishing, especially in the severer cases, was an act which made a vivid impression upon the mind, the mode in which that act had been performed in previous cases was apt to be remembered; of the several modes, that which was most approved by the public would naturally be followed the most frequently, and at last there would be a species of scandal, if it was unnecessarily departed from. In this way a uniformity, more or less perfect, was established, in punishing the more heinous offences; and in regard to them custom first established what had some small portion of the attributes of a law.

In those cases in which, without a call for punishment, the authoritative termination of a dispute was all that was required, the experience of what was necessary, not only for any degree of mutual comfort, but even for the means of subsistence, soon established a few leading points of uniformity. Thus, when a man had cultivated a piece of ground which belonged to nobody more peculiarly than to himself, it was evidently necessary that the crop should be considered as belonging to him; otherwise, no crops would be raised, and the community would be deprived of the means of subsistence.

These general feelings, with the remembrance, more or less perfect, of what had been done in similar cases, were the only guide; and it is surprising to what an extent, over the surface of the whole globe, law has, in all ages, remained in that state of imperfect existence, if, indeed, with any propriety, it can be called a state of existence. In every part of Asia, and in all ages, law has remained in that state of existence or non-existence. In Europe, where, at a pretty early period, it became the practice to record in writing the proceedings of the judges, the natural propensity of referring to the past as a rule for the present begat in time a species of obligation of being directed by the examples which had already been set. This created a uniformity and certainty, which, however imperfect, afforded something better than the arbitrary proceedings of Asiatic judges. Yet this was a benefit which had a dreadful alloy. A body, not of law, but of decisions, out of which, on each particular occasion, a law for that particular occasion, as out of the crude ore, was to be smelted, hammered, and wire-drawn, was the natural material out of which to manufacture a system of chicane. How accurately the system of law, in the several nations of Europe, has conformed to the character of a system of chicane, is matter of present and lamentable experience. The uncertainty, the delay, the vexation and expense, and that immorality of the worst species with which they inundate the community, are not the only evils, great as they are, of laws constructed upon such a plan. A system of laws, so constructed, becomes an instrument of conservation for the barbarous customs and ideas of the times in which they were engendered; and infests society with the evils of an age which it has left behind.

To conceive the operations which are necessary to give effect to the enactments of the legislature, it is necessary to conceive the occasions which call for them.

When the legislature has established rights, so long as there is no dispute about those rights, and so long as there is no complaint of any violation of them, so long there is no occasion for any agency to give to the enactments of the legislature their effect. The moment, however, one person says, the right to that object is mine, and another person says no, but the right to that object is mine; or the moment any man complains that such or such a right belonging to him another man has violated, that moment occasion for the agency in question begins.

It is evident, also, that the operations necessary to give effect to the enactments of the legislature are confined to those two occasions, namely, that on which a right is disputed, and that on which it has been violated. On the occasions on which a right is disputed, it is requisite to determine to whom it belongs. On the occasions on which a right has been violated, it is sometimes only required to compel reparation to the injured party; sometimes it is necessary, besides, to inflict punishment upon the offender. The question is, What are the operations required for these several results?

Where a right is disputed, all possible cases may be resolved into that of A who affirms, and B who denies. That right is mine, says A; it is not yours, says B.

The first question to be asked of A is, which, among those facts which the legislature has determined shall give commencement to rights, happened in such a manner as to give commencement to that which is claimed as a right by him.

If no such fact is affirmed, the right does not exist. If some such fact is affirmed, it may be met by the opponent in one of two ways. B either may deny the fact, and affirm that the right never had a commencement; or he may allow the fact, and admit that the right had a commencement, but affirm that there had subsequently happened one of those facts which put an end to rights: admitting that A bought the horse, and had a right to him in the month of July, he might affirm that A sold him again in August, and by that transaction put an end to his right.

When B meets the affirmation of A in the first way, that is, by denying the commencement of the right, he may do it in either of two ways. He may deny the investitive fact which A affirms, or, not denying the fact, he may affirm some antecedent fact which deprived it of its investitive power. Thus, if A affirmed that he got the property by occupancy, B may affirm that it was not open to occupancy, but the property of another person. If A affirmed that he got the property by succession to his father, B may allow the fact of the succession, but affirm that the property did not belong to the father of A at the time of his death.

Whenever the legislature has accurately determined what are the facts which shall give commencement, and what those which shall give termination, to a right, the whole confused and intricate mass of what in English law is called *pleading*, reduces itself to these clear and simple elements. A begins by affirming some one of the facts which gives commencement to a right. B may deny this fact directly. A affirms contract, for example; B denies it; and then of course comes the evidence. Or, instead of denying it, B may affirm an antecedent fact which deprived the fact affirmed by A of its investitive force; or he may affirm a subsequent fact, which put an end to the right. In those two cases in which B affirms a new fact, A must be called upon for a reply; in other words, asked whether he admits or denies it. If he admits, there is an end of course to the claim of A. If he denies, then again we have affirmation and denial upon a matter of fact, which is to be determined by the production of evidence.

This is the first part of the proceeding, neither intricate nor obscure. The next is, the adduction of evidence. A fact is disputed; affirmed on the one side, denied on the other. A produces evidence to prove the fact, B produces evidence to disprove it. The decision is on the one side or the other, and the dispute is at an end.

If both parties obey the decision, there is no occasion for another act. If the losing party disobeys, force is necessary to compel obedience. This is called execution, and terminates the agency required.

It is needless to particularize a penal proceeding, all the possible varieties of which fall under one or other of the cases illustrated.

Thus, when a man is charged with a crime, the prosecutor affirms one of the acts violating rights, to which punishment is annexed by the legislator. The defendant can meet this affirmation in one of two ways only. First, he may deny the act, and then the second stage of proceeding, the adduction of evidence, immediately takes place. Or, not denying the act, he may affirm some previous act, which prevented it from having the effect of violating a right. Not denying the fact of taking the horse out of the field with a view to appropriate him, he may affirm a previous purchase, gift, &c. The adduction of evidence has nothing peculiar in the case of a penal proceeding at law. In the last stage, that of execution, the peculiar act of inflicting punishment is required.

Having thus a view, though very summary, of the operations required, we shall be the better able to judge of the agents necessary for the performance.

The stages, we have observed, are three. The *first* is that in which the plaintiff adduces the fact on which he relies, and is met by the defendant either with a denial of the fact, or the affirmation of another fact which, to maintain the suit, the plaintiff must deny. The *second* is that in which evidence, to prove or disprove the fact on which the affirmation and denial of the parties ultimately rests, is adduced and decided upon. The *third* is that in which the operations are performed necessary for giving effect to the sentence of the judge.

First stage of the judicial business.

What is desirable in the operations of the first stage is, 1*st*, That the affirmations and negations with respect to the facts should be true; and, 2*dly*, that the facts themselves should be such as really to have the quality ascribed to them. For the first of these purposes, all the securities which the nature of the case admits of, should be taken, for the veracity of the parties. There is the same sort of reason that the parties should speak truly, as that the witnesses should speak truly. They should speak, therefore, under all the sanctions and penalties of a witness. They cannot, indeed, in many cases swear to the existence or non-existence of the fact, which may not have been within their cognizance. But they can always swear to the state of their belief with respect to it. For the second of the above purposes, namely, that it may be known whether the facts affirmed and denied are such as to possess the quality ascribed to them, two things are necessary: the first is, that all investitive and divestitive facts, and all acts by which rights are violated, should have been clearly predetermined by the legislature; in other words, that there should be a well-made code: the second is, that the affirmations and denials with respect to them should be made in the presence of somebody capable of telling exactly whether they have the quality ascribed to them or not. The judge is a person with this knowledge, and to him alone can the power of deciding on matters so essential to the result of the inquiry be intrusted.

To have this important part of the business done, then, in the best possible way, it is necessary that the parties should meet in the very first instance in the presence of the judge. A is asked, upon his oath, to mention the fact which he believes confers upon him or has violated his right. If it is not a fact capable of having that effect, he is told so, and his claim is at an end. If it is a fact capable of having that effect, B is asked whether he denies it; or whether he affirms another fact, either one of those which, happening previously, would prevent it from having its imputed effect, or, in a civil case, one of those which, happening subsequently, would put an end to the right to which the previous fact gave commencement. If he affirmed only a fact which could have neither of these effects, the pretension of B would be without foundation.

Done in this manner, the clearness, the quickness, and the certainty of the whole proceeding are demonstrated. Remarkable it is, that every one of the rules for doing it in the best possible manner is departed from by the English law, and that to the greatest possible extent. No security whatsoever is taken that the parties shall speak the truth; they are left with perfect impunity, aptly by Mr Bentham denominated the *mendacity-license*, to tell as many lies as they please. The legislature has never enumerated and defined the facts which give commencement, or put a period to or violate rights; the subject, therefore, remains in a state of confusion, obscurity, and uncertainty. And, lastly, the parties do not make their affirmations and negations before the judge, who would tell them whether the facts which they allege could or could not have the virtue ascribed to them; they make them in secret and in writing, each along with his attorney, who has a motive to make them, not in the way most conducive to the interests of his client, but in the way most conducive to his own interests, and those of his confederates, from the bottom to the top of the profession. First, A, the plaintiff, writes what is called the declaration, an instrument for the most part full of irrelevant absurdity and lies; and this he deposits in an office, where the attorney of B, the defendant, obtains a copy of it, on paying a fee. Next B, the defendant, meets the declaration of A, by what is called a plea, the form of which is not less absurd than that of the declaration. The plea is written and put into the same office, out of which the attorney of the opposite party obtains a copy of it on similar terms. The plea may be of two sorts; either, 1*st*, a dilatory plea, as it is called; or, 2*dly*, a plea to the action. To this plea the plaintiff may make a *replication*, proceeding through the same process. To the replication the defendant may put in a *rejoinder*. The plaintiff may answer the rejoinder by a *sur-rejoinder*. This, again, the defendant may oppose by a *rebutter*, and the plaintiff may answer him by a *sur-rebutter*.

All this takes place without being once seen or heard of by the judge; and no sooner has it come before him than some flaw is perhaps discovered in it, whereupon he quashes the whole, and sends it to be performed again from the beginning.

This mischievous mess, which exists in defiance and mockery of reason, English lawyers inform us, is a strict, and pure, and beautiful exemplification of the rules of logic. This is a common language of theirs. It is a language which clearly demonstrates the state of their minds. All that they see in the system of pleading is the mode of performing it. What they know of logic is little more than the name.

The agency necessary for the performance of this portion of the business is some person who, when he hears a fact affirmed and denied, can tell whether it is one of those facts to which the legislature has attached the power of giving commencement or of putting a period to rights. It is evident, that on such occasion any one person, with the requisite knowledge, attention, and probity, is as competent to the task as a hundred. If he is single, the attention and probity is likely to be the greatest, as responsibility is not weakened merely, it is almost annihilated, by being shared. There should be one judge, therefore, and not more, to superintend that branch of procedure which consists of pleading.

ond ge of the cial iness.

The agency best adapted to the business of the second stage of judicature is that which next demands our attention. It is the business of taking evidence; in other words, the doing all that is necessary to ascertain whether the disputed fact happened, or did not happen.

The subject of evidence is a matter of complexity in the detail. And where any thing complex is to be stated in words, there is always difficulty in the expression, how plain soever the ideas. Such general considerations, however, as we can even here adduce, will, we hope, throw sufficient light upon the subject, to leave no doubt with respect to the conclusions which we have it in view to establish. This is one of the topics connected with law which Mr Bentham has exhausted, though a small part only of what he has written upon it has yet seen the light.[1]

With respect to all facts legally operative, that is, which give or take away rights, it is desirable that evidence amounting to proof should if possible always exist. With respect to a great proportion of them, it is in the power of the legislature to take measures that evidence of them shall be collected at the moment of their happening, and shall be preserved. This is the case with all those of which an evidentiary writing can be made and preserved by registration; all contracts, births, deaths, marriages, and so on. The proportion is really very great of the whole number of facts legally operative, in regard to which a legislature, by proper means, might secure the existence of evidence, and to that extent might either prevent disputes, or render the decision of them easy. That so little of this most important and obvious work has anywhere been done, only shows how ill the legislatures of the world have hitherto performed their duty. It is in the power of the legislature, by a proper classification, to have an accurate formulary for the different species of *contracts*, *wills*, and other *evidentiary writings*. Those formularies, properly made and printed with blanks to fill up, would render the business of *conveyancing*, which in England is a boundless, trackless, and almost impenetrable jungle, abounding with expense, with delay, and vexation to parties, with wealth and almost boundless power over the fortunes of other men to lawyers, a thing of the greatest simplicity, certainty, and ease.

Into the question of what might be and ought to be done by the legislature, for making and preserving evidence of the principal facts by which rights are made to begin or to end, we cannot enter at length on the present occasion. The great importance of the subject is evident from what we have thus shortly advanced.

The business of him who is only called upon to determine whether a disputed fact did or did not happen, is, to make the best use of all the evidence which exists, whether it were or were not desirable that more had been made to exist. For the best use of that which exists, three things are necessary:

1*st*, That the whole of it should be made to bear, that is, should be taken and applied.

2*dly*, That it should be taken in those circumstances which are most conducive to trust-worthiness.

3*dly*, That the proper value should be set upon each article, and upon the whole.

1. That the evidence may be taken as completely as possible, two things are necessary. The first is, that the judge should have power to send for, and to compel the attendance of, all persons and things which may be capable of affording evidence. The second is, that the evidence should all be taken, and nothing be omitted or lost.

It is not necessary here to enter into any details with respect to the first of those requisites. The necessity of the power is obvious, and the end to be attained is so precise and perspicuous, that there can be no difficulty in conceiving the mode of putting together and applying the means. There is no limit, it is obvious, to the physical power which should be placed at the disposal of the judge. He ought to have the right of calling upon every man, upon the whole community, to aid him in any act which is necessary to the performance of any part of his judicial duty; because any force opposed to the performance of that duty, there ought to be a force sufficient promptly to overcome. It is convenient, however, to the community, instead of being liable to be called upon individually, for the performance of the ordinary services auxiliary to the business of the judge, to provide him with a proper number of officers paid for attending to execute his commands. Their principal business, as regards this stage of the judicial proceedings, is, to serve notice upon any persons whose own presence, or that of any writing or other thing which they may possess, is required by the judge. Persons or things subjected immediately to the operations of judicature have a particular name in English. They are said to be *forthcoming*, a word which has an exact equivalent in few other languages, and is exceedingly appropriate and useful. It is of the greatest convenience, when a concrete term, the use of which is very frequent, has an abstract term corresponding to it; as good has goodness; hard, hardness; and so on. There was not any word in the language corre-

[1] This part of Mr Bentham's writings has been presented to the public by Mr Dumont, the first of translators and redacteurs, in that happy form which he has given to other portions of that philosopher's manuscripts.

sponding in this way to *forthcoming*. Mr Bentham, perceiving the great need of it, made the term *forthcomingness;* not exceptionable on the score either of harshness or obscurity. The small wits thought proper to laugh at him. We shall, nevertheless,—sorry at the same time that we cannot supply a defect in the language without offending them,—make use of the word, in which we find great appropriateness and great convenience. This particular branch, therefore, of the judicial agency, is that which relates to *forthcomingness;* and forthcomingness is required for two purposes, both for evidence and for justiciability; for evidence, that a true decision may be passed; for justiciability, that the sentence of the judge may not fail of its intended effect.

So much with respect to the forthcomingness of evidence. The second condition required to give the decision the benefit of all existing evidence is, that the whole should be taken, and that not any part of it which can be taken without preponderant inconvenience should be excluded and lost.

Of the several articles of evidence, some will always be of more importance, some of less; and some may be of very little importance; but whether of little or of much, it is always desirable that all should be taken, and every the smallest portion counted for what it is worth. The discovery of truth is promoted by taking advantage of every thing which tends to throw light upon the subject of dispute.

These propositions it may appear to be useless, indeed impertinent, formally to state. They are too evident, it may be said, to be disputed, and too important to be overlooked. Important as they are, and undisputed by all the rest of the world, they are not only disputed, but trampled upon, by lawyers, especially English lawyers. They have unhappily established a set of rules in direct opposition to them. These rules they applaud in all forms of expression, and celebrate as guards and fences of all that is dear to mankind.

In all causes, they have determined that persons so and so situated, things so and so situated, though apt to be pregnant with information beyond all other persons and things, shall not be admitted as sources of evidence. Thus, in English law, we have incompetency of witnesses, that is, exclusion of them, 1*st,* from want of understanding; 2*dly*, from defect of religious principle; 3*dly*, from infamy of character; 4*thly*, from interest. These are undisguised modes of exclusion; besides which, there is an extensive assortment of disguised modes. Under this title comes the rule, that only the best evidence be given which the nature of the case admits of; according to which, it often happens that the only evidence which can be had is excluded. Under this title also falls the rule, making certain kinds of evidence conclusive, by which proceeding all other evidence is excluded. To the same list belongs the rule that hearsay evidence is not admissible. The rules, so extensive in their application, by which writings are wholly rejected, only because they want certain formularies, are rules of exclusion; and so are the limitations with respect to time, and to number of witnesses. Into the very extensive subject, however, of the absurdity and mischievousness of the rules of evidence in English law, we cannot pretend so much as to enter. A remarkable exemplification of them was afforded on the trial of Warren Hastings, to which, for this purpose, the reader may be referred. (See Mill's *History of British India*, book vi. chap. ii.)

The only conceivable reasons for the exclusion of evidence are three:

1. Irrelevancy.
2. Inconvenience in obtaining and producing.
3. Danger of deception.

With regard to irrelevancy, the decision is clear. What has no tendency either to prove or disprove the point in question, it would be loss of time to receive.

With regard to inconvenience, it is no doubt liable to happen, that when all the good which can be expected from the obtaining of a lot of evidence is compared with the evil of the delay, cost, and vexation, inseparable from the obtaining of it, the evil may be more than an overmatch for the good. In all such cases it is expedient that the lot of evidence should be foregone.

As a guard against the danger of deception, it is equally certain that no evidence ought ever to be excluded. An account of all the reasons by which the absurdity of exclusion on this ground is demonstrated, and of the wide and deplorable mischief which, in the vulgar systems, is produced by it, would be far too extensive for the contracted limits of the present discourse. Reasons, however, decisive of the question, present themselves so obviously, that hardly any man, with an ordinary understanding, not fettered by prejudice, can look at the subject without perceiving them.

If evidence is to be received from no source from which evidence, liable to produce deception, is capable of coming, evidence must not be received at all. Evidence must be received from sources whence false evidence as well as true is liable to flow. To refuse all information from such sources, is not the way by which a knowledge of the truth can be obtained. This is the way to make sure of not having that knowledge. The means of obtaining it are, to receive information from every possible source, and to separate the bad from the good, under all those securities, and by the guidance of all those marks, of which understanding and attention know how to avail themselves.

It is not enough to say, we will receive information from those sources only which are least likely to yield deceptious evidence, refuse to receive it from those which are most likely. You are obliged to receive it from sources differing in almost all possible degrees of likelihood. Where are you to draw the line of separation? Is not the same discernment which guards you against the danger of false information from the sources which you deem the least likely to yield it, sufficient to guard you against it from those sources which you deem the most likely to do so? In fact it will be still more sufficient, because in this case you will be much more apt to be upon your guard. The very best information is, in truth, liable to be derived from the very worst of sources,—from a man who, you know, would not tell you one word of truth if he could help it.

The securities that a man will give true information, independently of those artificial securities which the legislature can apply equally to all, are, 1*st*, intelligence; 2*dly*, probity; 3*dly*, freedom from interest. Suppose that one or two or all of these securities are wanting, it only follows, that what he states should be heard with a proportional distrust. It may still be of the utmost importance to the discovery of the truth that he should be heard. Hear him with the proper allowances. This must always be more favourable to the discovery of the truth, than that he should not be heard at all. His testimony may appear, when heard, to be utterly unworthy of credence. But that could not be known till it was heard and examined. It might have so been, that it was not only worthy of credence, but completed the proof of a fact of the greatest possible importance. That a man should not be heard as a witness, on account of his religious creed, is an absurdity which we cannot descend to notice.

2. The second of the three things which we found necessary, as above, for making the best use judicially of whatever evidence to the fact in question exists, was, that it should be taken under those circumstances which are most

conducive to trust-worthiness. Those circumstances are constituted by the artificial securities, which arrangements can be made to apply. The following enumeration of them has been made by Mr Bentham (*Introduction to the Rationale of Evidence*, p. 54), and appears to be complete.

1. Punishment.
2. Shame.
3. Interrogation, including counter-interrogation.
4. Counter evidence,—admission of.
5. Writing,—use made of it for giving permanence, &c. to evidence.
6. Publicity,—to most purposes, and on most occasions.
7. Privacy,—to some purposes, and on some occasions.

For developing the import of these several securities, we can afford to say nothing. The principal operation of the judicial functionary in this part of the business is, to preside over the interrogation; to see that it is properly and completely performed. The question, then, what is the sort of agency best adapted for the performance of this part of the task of taking evidence, is not difficult to answer. There is nothing in it which one man, with the proper intellectual and moral qualifications, is not as capable of performing as any number of men.

3. All the existing evidence being collected and received, it only remains that the proper value should be attached to the several portions, and a corresponding decision pronounced.

It is sufficiently evident that, for the performance of this duty, no very precise instructions can be laid down. The value which belongs to an article of evidence often depends on minute and almost indescribable circumstances; and the result must be left to the sagacity and conscience of the judge.

At the same time, however, service to this end, and of the greatest importance, may be, and of course ought to be, rendered by the legislature. The different marks of trust-worthiness may, to a certain extent of particularity, be very correctly described. This being done, the difference between the value of any two lots of evidence to which those marks attach may be very exactly ascertained. One has a certain number of the marks of trust-worthiness, as laid down by the legislature; another has all these and so many more; the result is clear. It is evident, that as far, in this respect, as experience and foresight can go, nothing should be left undone by the legislature.

Another important service can be rendered by the legislature, and that is, to provide an accurate language for the judge; a language in which he can express precisely the degree of value which he allots to each article of evidence, and to the whole. Various expedients may be adopted for this purpose. A very obvious one is, to fix upon some particular, well-known article of evidence, the value of which all men appreciate equally; the clear testimony, for example, of a man of the ordinary degree of intelligence and probity, as a standard. Is the value to be expressed, which the judge attaches to any other article of evidence? If inferior to the standard, it falls below it by so many degrees, one, two, three, four; if superior, it rises above it by so many.

Having provided an accurate language, the legislature should take security that it be used; and admit of no vague and general expressions in the account of the value which the judge attaches to each article of the evidence on which he grounds his decision.

At the same time that the legislature insists upon the use of precise language in stating the value of evidence, it should insist upon reasons; upon receiving from the judge a precise statement of the grounds upon which he attaches such a value, and no other, to each and every article of evidence; that is, upon receiving a reference, as exact as language can give, to each of the circumstances which contributed to suggest to him that particular estimate which he says he has formed.

Of the importance of all these expedients we presume that no illustration is required.

Third stage of the judicial business.

We come now to the third and last stage of the business of judicature; when all that remains is to carry into effect the sentence of the judge.

When they upon whom the sentence operates are willing to obey, all that is necessary is to afford them notice of what it requires them to perform. In well-ordered countries, all but a very insignificant number will be found to be cases of this description. When opposition is to be overcome, a physical force must be provided, sufficient for the purpose. As there seems nothing mysterious in determining how this should be formed, and under what rules it should act, to secure the ends for which it is provided, with the smallest possible amount of collateral evil, we shall here take leave of the subject.

The judicial establishment, or the best form for giving effect to the laws.

VII.—We have now seen the whole of the operations to be performed. The parties are required to state before the judge the investitive or divestitive facts on which they rely. If they state, for this purpose, a fact which is not possessed of those qualities, they are immediately told that it is not possessed of them, and not calculated to support their claim. They come, by two or three steps at the longest, to a fact upon which the question ultimately turns, and which is either contested or not contested. In a great many cases it would not be contested. When the subject was stript of disguise, the party who had no right would generally see that he had no hope, and would acquiesce. The suit would thus be terminated without the adduction of evidence. When it was not, the cases would be frequent in which it might be terminated by the evidence which the parties brought along with them. In these cases, also, the first hearing would suffice. A vast majority of the whole number of suits would be included in these two sets of cases. For the decision of a vast majority, therefore, of the whole number of suits, a few minutes would suffice. When all the evidence could not be forthcoming at the first hearing, and only then, would a second hearing be required. In this mode of proceeding, justice would be, that without which it is not justice, expeditious and cheap.

In all this there is nothing which one man, with the appropriate intellectual and moral qualities, is not as competent to perform as any number of men. As one man is cheaper than any greater number, that is one reason why no more than one judge should be allowed to one tribunal.

The next object of inquiry is, to ascertain what securities can be provided that those who are intrusted with the business of judicature shall possess the requisite intellectual and moral endowments.

Securities for the intellectual endowments of the judge.

The intellectual endowments depend upon those who have the power of choosing and of dismissing the judges, and who do or do not appoint men whose knowledge and capacity are ascertained. The moral behaviour of the judges depends upon the interests which act upon them in the situation in which they are placed.

Into the question, who should have the appointment of the judges, we do not intend to enter. The answer would be different under different forms of government; and this is not the place to compare the different forms of government, either for this or any other of the ends of its institution. One thing only we shall state, because it carries its evidence along with it. Those who appoint the judges ought to have no interest contrary to the best administration of justice.

As the uprightness of the judge is assailed by interests inseparable from his situation, viz. the profit which he may derive from misdecision, it is necessary to counterbalance

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Securities for the moral qualities of the judge.

them by opposite interests, assuming the character of securities. Several of the securities which we have already seen applying to the situation of witness, apply also to the situation of judge: some are peculiar to each. The following is the list of those which apply to the situation of judge.

1. Punishment.
2. Shame.
3. Publicity.
4. Writing, for the sake of accuracy and permanency.
5. Singleness of the functionary.
6. Appeal.

For the *punishment* of the several kinds of judicial offences, provision ought to be made in the penal code.

In the case of the judge there is particular occasion to point accurately, and to strengthen to the utmost, the operation of *shame;* for in the situation of judge it is possible to be guilty of offences very numerous and very serious, without permitting so much of evidence to attach to any definite act, as would suffice to form a ground for punishment.

The great instrument for the application of shame is *publicity.* The importance of publicity, therefore, is paramount. It is not only the great instrument for creating and applying the moral sanction, the approbation and disapprobation of mankind; but it is of essential service towards the application of punishment, by making known the occasions on which it is deserved. It is not only a great security in itself, but it is the principle of life and strength to all other securities.

All other publicity is feeble and of little worth compared with that of the *press.* Not only, therefore, ought this to be allowed to operate with its utmost force upon the judge, but effectual provision ought to be made to cause it to operate upon him with its utmost force. Not only ought the judgment-hall to be rendered as convenient as possible for the reception of the public; not only ought the greatest freedom to be enjoyed in publishing the proceedings of the judge, and in publishing all manner of observations upon them, favourable or unfavourable; but measures ought to be taken to make a public, and to produce publication, where there is any chance that a voluntary public, and voluntary publication, would be wanting. For this purpose, unless other very important considerations intervene, the judgment-seat should always be in that place, within the district to which it belongs, where the most numerous and intelligent public, and the best means of publication, are to be had.

In England, where there is no definition of libel, and where the judges, therefore, are allowed to punish, under the name of libel, whatever writing they do not like, the publishing of unfavourable observations on the conduct of a judge, nay, in some instances, and these the highest in importance, the simple report of his proceedings, is treated as one of the most heinous of all possible offences. No wonder! Allow judges, or allow any men, to frame laws, and they will frame them, if they can, to answer their own purposes. Who would not, if he could, make a law to protect himself from censure? More especially if he were a man disposed to act in such a way as to deserve censure.

Would you allow falsehood to be published against the judge? The word falsehood is here ambiguous. It means both erroneous opinions, and false statements with regard to fact. Erroneous opinions we would undoubtedly permit, because we know no standard for ascertaining them, other than that which is afforded by public discussion; and because this is an adequate remedy for all the evil which erroneous opinions have any tendency to produce. Affirmation of facts injurious to the judge, if false, and made without reasonable grounds for having been believed to be true, we would prevent.

Allow facts injurious to the judge to be published, even when true; allow comments unfavourable to the judge to be made upon his actions, you discredit the administration of justice. Discredit the administration of justice, to which the people are resorting every day for the greatest of all possible benefits, protection from injury! As well talk of discrediting the business of a bread-baker, a meat-seller, if the fraudulent dealer is exposed to the censures of the public! Discredit the administration of justice, indeed, by taking measures of security against the vices of judges, indispensable for its perfection!

The importance of *recording, in permanent characters,* what takes place before the judge, we must content ourselves with assuming. We may do so, it is presumed, with propriety, on account of the facility with which the reasons present themselves. We must also leave it to our readers to draw the line of distinction between the occasions on which it is requisite, and the occasions on which it may be dispensed with; the occasions, for example, where everything is simple and clear, and all parties are satisfied.

It is a great security, both for diligent and for upright conduct in the judge, that he occupy *singly* the judgment-seat. When a man knows that the whole credit and reward of what is done well, the whole punishment and disgrace of what is done ill, will belong to himself, the motive to good conduct is exceedingly increased. When a man hopes that he can shuffle off the blame of negligence, the blame of unfairness, or fix a part of it on another, the uncertainty of the punishment operates, as we have already seen, to the diminution, and almost to the extinction, of its preventive force. Certain common, and even proverbial expressions, mark the general experience of that indifference with which a duty that belongs in common to many is apt to be performed. What is every body's business is nobody's. This is as true in the family as in the state; as true in judicature as in ordinary life. Much remains to be said upon this topic, which is one of great importance; but we must pass to the next.

Of the use of *appeal* as a security against the misconduct of the judge, there is the less occasion to adduce any proof, because it seems to be fully recognised by the practice of nations.

One thing, however, which is not recognised by that practice is, that if it is necessary in any one sort of causes, so it is in every other, without exception. Not a single reason can be given why it should exist in one set of cases, which is not equally strong to prove that it should exist in every other.

It is instructive to observe the cases in which it has been supposed that it ought to exist, and the cases in which it has been supposed that it might be omitted. The cases in which it has been thought necessary, are those which concern property of considerable value. Those in which it has been dispensed with are those which concern property of inconsiderable value. The first set of cases are those which are of importance to the aristocratical class, the second are those which are of no importance to that class. It is the aristocratical class who have made the laws: they have accordingly declared that the suits which were important to them should have the benefit of appeal; the suits not important to them should not have the benefit of appeal.

We recognise only one standard of importance, namely, influence upon human happiness and misery. The small sum of money for which the suit of the poor man is instituted is commonly of much greater importance to him, than the larger sum for which the suit of the rich man is instituted is to the rich. Again, for one rich man there are thousands and thousands of poor. In the calculation, then, of perfect benevolence, the suits for the small sums are not, as in the calculation of perfect aristocracy, those of the least, or rather no importance; they are of ten thousand times greater importance than the suits for the largest sums.

If an appeal ought to be had, how many *stages* should there be of appeal? This question, we imagine, is easily answered. If you go for a second judgment, you should, if possible, go to the very best source: and if you go at once to the best source, why go any farther?

What is required to be done, in the case of an appeal, is the first thing which deserves to be ascertained. An appeal takes place in consequence of a complaint against the previous judge. Where no complaint, there is no appeal, nor place for appeal.

A complaint against the judge must relate to his conduct, either at the first, the second, or the third stage, of the judicial operations.

If to his conduct at the first stage, it must be a complaint of his having permitted a party to rest upon a fact which had not the investitive or divestitive quality ascribed to it; and this implies either a mistake with respect to the law, or that he allowed the decision to turn upon a fact which did not embrace the merits of the question. It is evident that, for the decision of this question, all that is necessary is an exact copy of *the pleadings*, and transmission of it to the court of appeal.

If the complaint relates to his conduct at the second stage, it must turn upon one of two points; either that he did not take all the evidence, or that he did not properly determine its value.

If he did not take the evidence properly, by a failure either in assembling the sources of it, or in extracting it from them when assembled, the proper remedy is to send back the cause to him, with an order to supply the omission; or, if he be suspected of having failed wilfully, to send it to the judge of one of the neighbouring districts, to retake the evidence and decide.

If the complaint relates to a wrong estimate of the evidence, the statement of it transmitted to the court of appeal, with the reasons assigned by the judge for the value affixed to every portion of it, will enable the appellate court to decide.

With regard to the third stage, the only complaint there can be is, that the judge has not taken measures to execute his own sentence. If any inquiry is in this case to be made, the proper course is, that the appellate court refer it to one of the neighbouring judges. When a simple act is to be done, the proper order is to be despatched, and the proper penalties for non-performance exacted.

It thus appears, that for every thing which is required to be done by the appellate judicature, nothing whatsoever is required, as a foundation, but certain papers. The presence is not required either of parties or of witnesses.

As it is of no great consequence, in a country in which the means of communication are tolerably provided, whether papers have to be transmitted 50 or 500 miles, the distance, even though considerable, of the seat of the appellate jurisdiction is a matter of very little importance. The object, then, is to get the best seat; that is, the best public. The best public, generally speaking, is in the capital. The capital, then, is the proper seat of all appellate jurisdiction. And that there should be one judge, and one judge only, in each court of appeal, is proved by exactly the same reasons as those which apply to the courts of primary jurisdiction.

The question, how many courts there should be, as well of primary as of appellate jurisdiction, is to be determined by one thing, and one thing only; namely, the need there is for them. The number of the courts of primary jurisdiction must be determined, in some instances, by the number of suits; in some, by local extent. To render justice sufficiently accessible, the distance from the seat of judicature must not be great, though the number of accruing suits, either from the paucity or from the good conduct of the people, should be ever so small.

As the judgment-seat should never be empty, for the need of staying injustice is not confined to times and seasons, and as one judge may be sometimes ill, sometimes called to a distance even by the duties of his office, provision ought to be made for supplying his place. For this purpose, the proper expedient is a deputy. That the deputy should well perform his duty, the best security is, that he should be chosen and employed by the judge, the judge being responsible for the acts of the deputy as his own. Whatever it be which the judge cannot do, or cannot conveniently do, in that he may employ his deputy. If there is a great influx of causes, the deputy may be employed in some of the least complex and difficult. If there is any business not of first-rate importance, requiring the presence of the judge at a distance, the delegation of the deputy or deputies is the proper resource.

Besides the judge and his deputy, there are two adjuncts to every tribunal, which are of the utmost importance; indispensable, indeed, to the due administration of justice. These are, a *pursuer-general* and a *defender-general*. The business of both pursuer-general and defender-general is, to reclaim the execution of all laws in the execution of which the nation has a peculiar interest, though individuals may not. The peculiar business of the pursuer-general is to act on behalf of the administrative authority, in its character of plaintiff, and on behalf of every plaintiff who is without the means of engaging another advocate; to obviate any prejudice he sees likely to arise to justice from the conduct of plaintiffs, whether in civil matters or penal; and to perform, in the case of all offences where no private prosecutor appears, the office of prosecutor. The peculiar duty of the defender-general is to act on behalf of the administrative authority in its capacity of defendant, and on behalf of every defendant who has not the means of engaging another advocate, and to obviate any prejudice he sees likely to result to justice from want of skill or other causes on the part of a defendant who pleads his own cause, or on the part of the advocate who pleads it for him.

The courts of appeal, though all seated in the metropolis, ought to be as numerous as the speedy hearing of all the appeals which come to them requires. The judges of appeal ought all to be chosen from the judges of primary jurisdiction, not only on account of the education and the experience received, but as a step of promotion, and a proper motive to acquire the requisite education, and to merit approbation in the inferior employment. There is the same propriety, and for the same reason, in choosing the judges of primary jurisdiction from the deputies. (A. A. A.)

JURY, a certain number of men sworn to inquire into and try a matter of fact, and to declare the truth upon such evidence as shall appear before them.

JURY TRIAL. The method of trial by jury is one of the most ancient of judicial institutions; so ancient, indeed, that its origin lies beyond the commencement of authentic history amongst the nations of Europe, particularly in the north. In the earliest of the Scandinavian histories, it is spoken of or referred to as familiarly known. The oldest code of Iceland, composed in the beginning of the tenth century, also treats of it as an existing institution; and so also does the most ancient Norwegian code, the precise date of which has not been ascertained. Kofod Ancher, a sagacious critic and eminent lawyer, does not scruple to admit the authority of the Edda, from which it would appear that Odin had introduced this method of trial into Scandinavia. But all that the Edda says is, that Odin ordained the twelve Asagods to adjudge all causes in the metropolis of Asgard. It is curious to observe, however, that the old juries invariably consisted of twelve; a number which seems to characterise the institution as one of high antiquity; for as the verdict was commonly given by the majority, an uneven number would have been preferable, to avoid the contingency of an equality of votes. Saxo informs us, that Ragnar Lodbrok, who, according to Torfœus, governed Denmark between the years 750 and 790, first instituted trial by jury; but the authority of this monastic writer is not such as to induce us to attach much importance to his statement. In fact, the Edda is a much better historical authority than Saxo; and, according to that record, trial by jury is several centuries older than the commencement of Ragnar Lodbrok's reign, in the year 750 of our era. But the precise antiquity of this institution cannot now be determined. We find that it was in existence at the earliest dawn of northern history, and spoken of as a mode of trial then familiarly known; but beyond this all is conjecture. We can trace it as far back as a thousand years; this is the farthest limit to which legal antiquaries have carried their researches, the history of northern Europe, before that period, being involved in Cimmerian darkness.

It seems pretty certain, however, that, though trial by jury was early known in Scandinavia, yet it was not so generally resorted to before the beginning of the tenth century as afterwards. In these rude times, trial by battle often superseded trial by jury. Men of rank, or in other words warriors, always preferred it; they would have deemed it pusillanimous to submit any cause in which they were concerned to the decision of a jury. The weak and the aged alone claimed the benefit of this mode of trial; and women frequently appealed to it. Even after it had become common, the trial by battle, when demanded with certain legal formalities, was admitted in preference. In Scandinavia, however, this species of trial is of pagan origin; that is, it was in use prior to the introduction of Christianity into that northern region. But as the relations of society multiplied, and differences increased both in number and nicety, the inconvenience of such a mode of trial began to be felt. The *jus fortioris*, barbarous in itself, had no powers of adaptation. A man sometimes became involved in a new law-suit before he had recovered of his last wounds; some were prevented by the infirmity of age from prosecuting a cause in itself just; others had no male relations to espouse it for them; and a third class, though firmly convinced of the justice of their cause, were as fully persuaded of the superior strength or dexterity of their adversaries. Thus, the trial by battle became gradually unpopular; and hence, when the Christian faith began to be generally received, it rapidly declined, though without being entirely abolished.

In this state of things trial by jury would, in all probability, have become universal, if the clergy, who soon acquired great influence both with sovereigns and subjects, had not introduced a new mode of deciding causes. This was the Christian *ordeal*, which was more the result of circumstances than of any preconcerted design. The clergy had to preach a new faith to people slow of belief; and, as the arguments which they advanced in support of it were chiefly founded upon recorded or traditionary miracles, their sceptical hearers naturally asked, "Show us one such miracle, and we will believe." The validity of this reasoning has always been admitted by the Catholic clergy, who, accordingly, set about working miracles. Hence the origin of the Christian ordeal, which agreed with the trial by battle in this, that it was an appeal to heaven, though in a less rude and barbarous form. To a miracle said to have been performed by Bishop Pappo in Jutland, where, according to the legend, he put his hand in an iron glove red-hot, and withdrew it unhurt, is attributed the introduction of this method of trial into Denmark. This is a point which Ancher considers as established. But, whatever may have been the occasion of introducing it, the clergy endeavoured to substitute for every other kind of trial that which they called "the judgment of God;" and from this period the ordeal was frequently employed in all the countries of the north, particularly in Denmark, and in that part of Sweden called Scaney or Scania. In the code of laws still preserved, and known under the name of *Shaanske Lov*, or *Lex Scanica*, the ordeal of hot iron is expressly ordered to be employed, particularly in cases of theft. This mode of trial subsisted during two centuries and a half; but, though frequently employed during that period, it was always regarded with suspicion and distrust by the greater number of the laity. It afforded occasions for jugglery and deception to which the most ignorant could scarcely be altogether blind. By a little dexterity of management, the innocent might be condemned, and the guilty suffered to escape.

We have already seen that the insufficiency of the trial by battle was early felt, and that, as society advanced, the law of the stronger fell into disuse. The same fate likewise awaited the trial by ordeal, which, being substituted in its stead, long retarded the adoption of trial by jury. But, whilst each of these three modes struggled for pre-eminence, that by jury was always considered as the most *normal* or regular; and hence the appellation of *law*, which, in Denmark, was applied to a jury of a particular description. The trial by battle, and the ordeals, were no doubt recognised and admitted by the law; but every one felt that the trial by the country was the only one to which the term *legal* could with propriety be applied. That form of trial was the *law*, κατ' ἐξοχην, although the other forms were not contrary to the law; and this superior *legality* the ancients vindicated, in the strongest manner, by the term they employed. Thus, in the history of the northern judicatories, we recognise, first, the *trial by battle*; secondly, the *trial by ordeal*; and, thirdly, the *trial by jury*. This, however, is to be considered only as the order of general usage or practice; for, although some theorists have assumed that trial by battle is the most ancient mode, there is sufficient evidence to prove that which we have already stated, that amongst the northern nations trial by jury is at least of equal antiquity. In fact, it cannot be said that the most ancient codes sanction any other form of trial than that by jury. In none, not even in those of the tenth century, is the trial by battle even mentioned; and very few have prescribed the ordeals, which, being ecclesiastical inventions, must consequently be sought for chiefly in the ecclesiastical codes. But all the ancient laws abound with references to jury trial, and contain elaborate regulations respecting its form, applications, contingencies, and uses. Hence it may, with some confidence, be concluded that the trial by jury is the most ancient *strictly legal* mode of trial which obtained in the countries of the north.

The time was when it would have been considered necessary to inquire whether any enactment respecting jury trial occurs in the *Sachsenspiegel*; a code which, according to an opinion once universal amongst jurists, had been compiled in the time of Charlemagne. But Couring, in his work *De Origine Juris Germanici*, has demonstrated that the Sachsenspiegel was compiled subsequently to the year 1230, though soon after that period; and this is also the period to which a philologist, unaided by history or jurisprudence, would refer that compilation. In fact, the Sachsenspiegel itself contains evidence that it was composed after the council of Lateran, held in the year 1215; for it mentions a prohibition against matrimony in the fifth remove, which was first issued by that council under Innocent III., though the bull on the same subject was not published until 1230; and hence it is probable that the Sachsenspiegel was not compiled until after that year. But as jury trial had been introduced into Britain, and other northern countries, long before this period, it follows that the authority of the Sachsenspiegel (a crude collection of ancient customs, moral precepts, legendary divinity, and nursery tales), is of no avail whatever in the present question. Yet, even in this code, something may be found analogous to the institution of jury trial, though, upon examination, it will be found difficult to determine whether the mode of trial indicated in the Sachsenspiegel should not be considered as *wager of law*, rather than trial by jury in the strict acceptation of the terms.

The case is quite different with respect to the ancient Saxon as well as Frisian law, two codes (if that which may easily be printed on a sheet of paper deserves the name of code) of high antiquity. The Saxon law is written in Latin, a language unknown in Saxony before the time of Charlemagne. It was discovered in the library of Fulda, and first edited at Basil by John Herald, in the year 1557. It is a Christian code, addressed to the Saxons, over whom the ancestors of Charlemagne had no authority, and with whom they had little or no intercourse. Spelman (see his Glossary under the term *Lex Saxonum*) attributes this code to Harald Bluetooth, king of Denmark, who reigned about the middle of the tenth century; and in this opinion he is supported by Adam of Bremen, Helmold, and Albert. But are the laws which Harald gave to the Transalbians and Frisians identical with the *Leges Saxonum* of Fulda, and with the Frisian laws which Siccama edited? We cannot say that this is certain; but it is at least highly probable, and such undoubtedly was the opinion of Spelman. Mr T. G. Repp, who has discussed this subject with much learning and ability, sums up his reasoning by stating that the *Capitularia* and the *Leges* could not emanate from the same legislator; that the *Capitularia* are justly attributed to Charlemagne, who could not, therefore, be the author of the *Leges;* that, as the *Leges* abrogate an enactment of the *Capitularia*, the former are consequently of more recent date; and that, as there is only a question as to two legislators, if Charlemagne be not the author, the *Leges* must be ascribed to Harald.

From these codes, if they may be called such, we find that the Saxons had no juries in the strict modern acceptation of the term. They had only *wagers of law.* A man, when accused of a crime, either paid a certain fine, or, if he wished to establish his innocence, he convened a certain number of persons, before whom he cleared himself by oath of the crime with which he was charged. From the words used in the Saxon and Frisian law, it is not clear in what manner the *conjuratores* were bound to swear; but it seems probable that they only affirmed upon oath their belief that the accused was innocent. The number of the *conjuratores* varied according to the magnitude of the crime; and the fine, in case the accused failed to prove his innocence, varied in the same ratio. For crimes of the least aggravated kind only three compurgators were required; for those of a more heinous character six were necessary; and for such as were marked by peculiar atrocity, eleven, the accused himself being the twelfth. But there were some crimes for which no fine was deemed a sufficient expiation; and in these cases no wager of law is mentioned, because it was not allowed. From the nature and constitution of this mode of expurgation, it is obvious that unanimity was indispensable. This seems to be implied in the words *Undecima manu jurat;* nor could it well be otherwise, seeing that the accused chose his own jurors or compurgators.

Although Norway derived from Sweden the stock of its actual population, and the first seeds of civilization, yet, strangely enough, there are preserved Norwegian codes of higher antiquity than any now extant in Sweden. The history of Norwegian law has been divided into three periods; the first commencing in the reign of Hakon Athelstane, about the year 940; the second in the reign of Magnus, about 1274; and the third in 1397, at the union of Calmar. During all these periods, the trial by jury was more or less used, and invariably prescribed by law. In the first and second periods its use was universal, scarcely any cause of importance being decided without the intervention of a jury; but in the second period, the authority of the jury was modified by the judges acquiring greater authority in every judicial decision, and exercising, as they still do, an influence on the verdict; and, during the third, this authority and influence increased so greatly, that, by the end of the seventeenth century, the functions of the jury had become almost nominal, and, in many cases, were entirely superseded. The constitution of Norwegian juries is clearly explained in Lagabœtir's amended Law of Gulathing (b. i. c. 2 and 3), promulgated by King Magnus; *thing*, in the Scandinavian countries, signifying an assembly of the deputies of the people. The Lögman or Lawman presided, and his function originally was to recite the laws of the land, which he knew by heart; but after the promulgation of King Magnus's code, he had only to state the king's written law, to interpret it, and to point out the portion which applied to each particular case. It is not certain by whom, practically, juries were most frequently selected; but, from the northern codes, it appears that they might be chosen, first, by the deputies from their own number; secondly, by the lawman; thirdly, by the officers of the crown; and, lastly, by the parties themselves. It seems probable, however, that in Norway, juries were commonly chosen by the deputies. In the old Saxon, Danish, and Icelandic laws, a simple majority of the jury decided finally, and without appeal, in every case brought before them. But Magnus, in the event of a difference of opinion, gave the power of decision, not to the majority, but to the lawman along with the minority; reserving to himself the privilege of reversing their verdict, in the last resort, and, if he so pleased, affirming the deliverance of the majority. Further, by the code of this prince, the lawman was for the first time constituted a judge; the judicial authority of the crown was extended; unanimity was not insisted on, any more than in other Scandinavian laws; the king was virtually constituted supreme judge; and it was provided, that in all cases where the law did not decide, that was to be considered as the law which the jurors agreed upon.

We find jury trial described in the ancient codes of Sweden, a country where the regulations respecting it are in some instances stricter and more detailed than in Norway, where this institution has been more fully developed for the trial of every description of causes, and where, also, it has longer subsisted in full force. There were several kinds or species of jury in Sweden, viz the Lawman's, the Bishop's, and the Hundred's jury; but in all, the decision of the majority was final. The circumstances and ceremonies attending the election of jurors, the qualifications which rendered them eligible, the parties who elected them, the oath which they took before proceeding to try a case, and the validity of their deliverance or verdict, together with the functions of the lawman, will all be found stated and explained in Mr Repp's very curious book, to which the reader is referred. The king's jury consisted of twelve, and constituted a species of appeal court; it took cognisance of all offences against the public law of the state calculated to disturb or molest the people; and its decision was in every case final. No servant could be a juror; they required to be men having a fixed residence; and persons of infamous character or lawless habits were also excluded. The absence of a juror subjected the absentee to a heavy fine. Causes of every description appear to have been tried by Swedish juries. Important questions of property, as well as criminal cases of every kind, were referred to their decision; they formed a sort of mixed tribunal, by which the law as well as the fact was determined; and, in particular circumstances, they acted as a court of review, as in the case of the king's jury on the Landsthing, before which causes o. great importance came ultimately for decision. In fact, the only limitation (if limitation it may be called) in the authority of the jury to judge and decide, consisted in this, that cases of minor importance which occurred between terms, were adjudicated by the magistrate or the lawman, whilst all causes of moment were reserved for the cognisance of the jury.

The subject of Danish juries has been ably treated by Peter Kofod Ancher, for many years professor of the civil law in the university of Copenhagen, a writer who, in his *Dansk Lovhistorie* (Copenhagen, 1769–1776, in 2 vols. 4to), has surveyed ancient judicial institutions with a scrutinising eye. Ancher is by no means an admirer of this form of trial; but, as he is a conscientious and critical historian, he takes pains to place every fact in its true light, without reference to his own particular views or opinions. According to him, there were four kinds of persons employed in the ancient courts of Denmark to adjudicate causes; and these were either regular jurors, or *conjuratores* in a wager of law, or persons who, from the principles on which they were nominated, resembled these. He then proceeds to consider each of the four classes separately, viz. first, the *Tingmænd* or Thingmen, that is, those who frequent a Thing, or are enjoined by law to be present at it; secondly, the *Nævninger*, or regular juries, an institution of very high antiquity in Denmark; thirdly, the *Sandemænd* or Truthsmen, who were employed for deciding important causes, and took cognisance of homicide, cutting and maiming, rape, armed aggression, disputes respecting boundaries, and questions in which church property was concerned; and, lastly, the Wager of Law in Denmark. For ample details under each of these heads, we refer to Ancher's work above mentioned, and also to the distinct and satisfactory abridgment of his investigations, given by Mr Repp in his book on Ancient Juries. It is sufficient to state here, that in Denmark trial by jury was not resorted to excepting in causes of importance, and that particular care was taken that none but good and impartial men should be chosen as jurors. They were selected from the inhabitants of a district generally; no friend or relative of the parties could be chosen; and they required to be men of substance, "three-marks-men," who could pay a compensation to the injured party, in case they found a wrong verdict. The number of Danish jurors was originally twelve, a number common to all the northern countries; but, at subsequent periods, the law of Denmark in this respect was somewhat changed. In Scania the jurors were twelve, but the accused was permitted to challenge three; and the Scanian law provided that the prosecutor should either nominate fifteen, or that, if three were challenged, he should pray a *tales* to complete the number twelve. The Jutland law, chary of numbers, provided that there should only be eight jurors in each hundred, or two in each quarter; but *kindred jury*, as it was called, consisted of twelve, as well as juries which took cognisance of forgery, arson, and highway robbery. By the law of Erik, the number of jurors in the more important class of cases was *thirteen*, and in the less important *seven*, that is, twelve, and the half of twelve, with one additional to secure a majority. In fact, the basis of all the numbers of jurors is the number twelve. In Denmark, as in Sweden and in Iceland, the cause was decided by the suffrages of the majority of the jurors impannelled in each case.

From these historical notices, it appears that trial by jury, in one or other of the various forms under which it is found, was not only of great antiquity amongst the northern nations, but employed to an extent of which, in this country, we have hitherto had no adequate conception. Nor can it be doubted that, for the institution which we now justly regard as the palladium of liberty, and one of the best safeguards against the arbitrary abuse of power, and which time and experience have enabled us to adapt to a more advanced state of society, we are indebted to those nations which we are perhaps a little too prone to undervalue, and which, even at a period of comparative barbarism, seemed to have fully divined the benefits which might accrue from this mode of deciding causes, whether civil or criminal. For accounts of the origin, progress, and improvement of jury trial in our own country, we must refer the reader generally to its history, and, in a particular manner, to the different institutional writers. (See Repp's *Historical Treatise on Trial by Jury, Wager of Law, and other co-ordinate Institutions;* also Blackstone's *Commentaries on the Law of England*, b. iii. c. 22, § 6.) (A.)

JUS DELIBERANDI, in *Scotch Law*, that right which an heir has, by law, of deliberating for a certain time whether he will represent his predecessor.

Jus Devolutum, in *Scotch Law*, the right of the church to present a minister to a vacant parish, in the event of the patron neglecting to exercise that right within the time limited by law.

Jus Mariti, in *Scotch Law*, the right which the husband acquires to his wife's moveable estate, in virtue of the marriage.

Jus Relictæ, in *Scotch Law*, the right which the wife has in the goods in communion, in case of the previous decease of the husband.

Jus Preventionis, in *Scotch Law*, the preferable right of jurisdiction acquired by a court, in any cause to which other courts are equally competent, by having exercised the first act of jurisdiction.

Jus Civile, amongst the Romans, signified no more than the interpretation given by the learned, of the laws of the Twelve Tables, though the phrase is now extended to the whole system of the Roman laws.

Jus Civitatis signifies the freedom of the city of Rome, which entitled those persons who had obtained it to most of the privileges of Roman citizens; yet it differed from the *Jus Quiritium*, which extended to all the advantages which a free native of Rome was entitled to. The difference, in fact, was much the same as that between *denization* and *naturalization* with us.

Jus Honorarium was a name given to those Roman laws which were made up of edicts of the supreme magistrates, particularly the prætors.

Jus Imaginis was the right of using pictures and statues amongst the Romans, and had some resemblance to the right of bearing a coat of arms amongst us. This honour was allowed to none but those whose ancestors or themselves had borne some *curule office*, that is, had been *Curule Ædile*, *Censor*, *Prætor*, or *Consul*.

The use of statues or pictures, which the *Jus Imaginis* conferred, was that of exhibiting them in funeral processions.

Jus Papirianum included the laws of Romulus, Numa, and other kings of Rome, collected into a body by Sextus Papirius, who lived in the time of Tarquin the Proud.

Jus Trium Liberorum was a privilege granted to such persons in the city of Rome as had three children, by which they were exempted from all troublesome offices. The same exemption was granted to any person who lived in other parts of Italy having four children; and those who lived in the provinces, provided they had five, or, as some say, seven children, were entitled to the same immunity.

JUSSIEU, Antoine de, doctor of physic, professor of botany in the Royal Garden at Paris, and a member of the *Académie des Sciences*, was born at Lyons in the year 1686, and educated at Montpellier, where he took his degree of doctor of physic, after which he became associated with the faculty of Paris. Although much occupied in the practice of medicine in the capital, he was ardently devoted to the study of botany, having, in the earlier part of his life, visited Spain and the southern provinces of France in search of plants. When stationary at Paris, he communicated various essays to the academy, which are printed in its *Mémoires.* These are chiefly botanical, illustrating the characters or the qualities of various exotics, at that period not well known; but he has given several papers also, on extraneous fossils, and a few other subjects of natural history. He furnished the two *Appendices* to Tournefort's *Institutiones Rei Herbariæ*, and edited the *Icones* of Barrelier. He also published an historical account of the magnificent collection of drawings of plants and animals, originally begun under the auspices of Gaston duke of Orleans, and continued down to the present times. When Linnæus visited Paris in 1738, he, in a letter to Haller, mentioned the elder Jussieu, as "much engaged in medical practice, well versed in the knowledge of the species of plants, though too prone to multiply them, and strictly confined to the ideas and principles of Tournefort." In one important point, however, which could hardly escape Linnæus, and ought not to be forgotten, he emancipated himself from the errors of his master, for he perfectly understood, and fully admitted, the doctrine of the sexes of plants. A letter of his, completely explaining this phenomenon on the most correct principles, is given by Bradley, in his *Philosophical Account of the Works of Nature* (p. 25–32). He died of an apoplectic fit, at Paris, on the 22d of April 1758, aged seventy-two.

Jussieu, *Bernard de*, younger brother of the preceding, and, like him, a physician, and a member of the *Académie des Sciences*, was still more devoted to the philosophical as well as practical study of botany, and ranks amongst the greatest names in that science, as having first attempted to form a system according to the *natural affinities of plants.* He was born at Lyons in 1699, and appears to have accompanied or followed his brother to Paris, where he occupied, under him, the place of botanical demonstrator in the *Jardin du Roi*, and at length succeeded him as professor of botany. If his communications to the academy were less numerous than those of his brother, they were of a rather superior character. In one of them, published in the *Mémoires* of that body for 1742, he enters on the subject, then scarcely touched by any person, of the animal nature of certain marine productions, previously taken for plants; and we perceive, in his inquiries, dawnings of that meridian light which our countryman Ellis afterwards threw on these curious tribes. On other occasions he explained the flowers of the *Littorella*, and, with much acuteness, the more obscure fructification of the *Pilularia.* He wrote, in conjunction with the learned Comte de Caylus, on the *Papyrus;* and he gave an improved edition of Tournefort's *History of the Plants about Paris*, in 1725.

Linnæus became personally acquainted with this ingenious man at Paris in 1738, and maintained, for some years, an intimate correspondence with him. They could not be long in each other's company without discussing the natural affinities of plants; a study which seems to have been much advanced, if not first excited, in the mind of Linnæus, by his correspondence with Haller. Bernard de Jussieu had probably about the same time been led to consider it by his own contemplations; for the system of Tournefort, in which he was educated, is too artificial in principle to have given him any such ideas. In its execution, indeed, that great author is led, by his own good sense, into some natural and philosophical views, even in spite of his system; and these may possibly have caught the attention of Jussieu. However this may be, mutual satisfaction and instruction could not but flow from the intercourse of Bernard de Jussieu and Linnæus. They traced out together the characters and the limits of various natural assemblages or orders. Every day produced, and every letter communicated, some new discovery. But as the multifarious hordes of the north appear originally to have used one common tongue, which, after they were dispersed, divided, and cultivated, when it came to be written, assumed the form of various distinct languages; so these two botanical philosophers, when their more intimate intercourse had ceased, pursued different paths, and went far towards different conclusions. Linnæus, after throwing the whole vegetable creation, more or less completely, into natural groups, became more and more persuaded that it was not only impracticable to connect them by one synoptic clue or system, but that not one of his assemblages or orders was capable of precise and unexceptionable definition. On the other hand, Bernard de Jussieu, to the last, aimed at a general scheme of classification, though he accomplished little more than throwing his several orders into larger assemblages, and disposing the whole, as indeed Linnæus himself has done, in one series, according to their relationship to each other. The French botanist is recorded to have spoken with great diffidence of his own performance, and he has written nothing of a general classification. But he often gave hints, in lectures or conversation, by which others perhaps profited. This appears from the preface to the *Genera Plantarum* of his distinguished nephew, Antoine Laurent de Jussieu, botanical professor at Paris, who, following up the ideas of his uncle, and sacrificing something to technical convenience, at the expense of nature, contrived to exhibit a tolerably natural system, founded on methodical principles.

It would be to little purpose to discuss, at the present day, the claims of Linnæus or of Bernard de Jussieu to originality in the study of natural orders. Professor de Candolle has justly asserted, that they had the same object in view, and adopted, in the main, the same principles. Bernard de Jussieu having, in a letter dated the 15th of February 1742, congratulated Linnæus on his appointment to the botanical chair at Upsal, says, "*Floræ devotus omninò poteris viam quam monstrasti facilem ampliùs aperire, naturalemque methodum tandem perficere, quam desiderant et expectant botanophyli omnes.*" In a subsequent letter of the 7th May, 1746, he also tells his Swedish friend, "*Scio quantum emolumentum receperint qui secundum tua principia student; memet experientia docuit.*" This is enough to settle the question, though great allowance is perhaps due to the modesty of Jussieu, who was less disposed to honour himself than his friend.

His biographer, the celebrated Marquis de Condorcet, records his singularly amiable and unaffected manners. These, during his occupation of arranging, according to natural classes, the garden of Trianon, attracted the notice and esteem of his sovereign, Louis XV. to whom any unsophisticated character or object could not but form an agreeable relaxation from the routine of a court. Jussieu obtained plants and seeds to be sent to his friend in the king's name. He pursued his innocent and useful studies till his death, which happened in 1777, in his seventy-ninth year.

A compendious view of his nephew's system, and a comparison of their natural orders with those of Linnæus, may be seen under the article BOTANY.

JUST, or JOUST, a sportive kind of combat on horseback, man against man, armed with lances. The word is by some derived from the French *jouste*, formed from the Latin *juxta*, because the combatants fought near one another. Salmasius derives it from the modern Greek *zoustra*, or rather ζουστρα, which is used in this sense by Nicephorus Gregorius. Others derive it from *justa*, which in the corrupt age of the Latin tongue was used for this exercise, because it was supposed to be a juster and more equal combat than that of the tournament.

The difference between jousts and tournaments consists in this, that the latter is the genus, of which the former is only a species. Tournaments included all kinds of military sports and engagements made for gallantry and diversions. Jousts were those particular combats where the parties were near each other, and engaged with lance and sword. It may be added, that the tournament was frequently performed by a number of cavaliers, who fought in a body; whereas the joust was a single combat of one man against another. Though the jousts were usually made in tournaments after a general rencontre of all the cavaliers, yet they were sometimes singly, and independent of any tournament. (See CHIVALRY and TOURNAMENT.)

JUST, *St*, a parish of Cornwall, in the hundred of Powder, 269 miles from London, in which is comprehended the borough-town of St Mawes. It is opposite to the port of Falmouth. The inhabitants amounted in 1801 to 1416, in 1811 to 1639, in 1821 to 1648, and in 1831 to 1558.

JUST, *St*, a large parish of the county of Cornwall, in the hundred of Penwith, 295 miles from London. It is in one of the mining districts, which affords employment to the inhabitants, who amounted in 1801 to 2779, in 1811 to 3057, in 1821 to 3666, and in 1831 to 4667.

JUSTICE, in a moral sense, is one of the four cardinal virtues, which consists in giving every person his due.

Civilians distinguish justice into two kinds, *communicative* and *distributive*. The former establishes fair dealing in the mutual commerce between man and man, and includes sincerity in our discourse, as well as integrity in our dealings. *Distributive* justice is that by which the differences of mankind are decided according to the rules of equity. The former is the justice of private individuals, the latter that of princes and magistrates.

JUSTICE is also an appellation given to a person deputed by the king to administer justice to his subjects, and whose authority arises from his deputation, and not by right of magistracy.

JUSTICE-CLERK OF SCOTLAND, the vice-president of the Court of Justiciary, in absence of the lord-justice-general. This officer was originally no other than the clerk to the Justiciar or Justice Court of Scotland, as the name indeed imports; and his progress from the table to the bench is singular, and not a little curious.

In early times there were two justice-clerks, as there were likewise two justiciars, one on either side of the Forth; and as the jurisdiction of the Justice Court was then nearly universal in respect of the matters cognisable there, and very high in degree, the office of clerk was of considerable importance, and enjoyed by persons of station in society. Thus we find that Adam Forrester of Corstorphine, justice-clerk benorth Forth (*temp.* Dav. II.), was in 1373 provost, or, as that officer was then called, alderman, of the town of Edinburgh, and in 1382 sheriff of the shire; and in 19 Rob. II., he was keeper of the great seal, in the absence of the chancellor, who had gone abroad.

In the beginning of the fifteenth century, the justice-clerks began also to act as public prosecutors before the justiciars, the latter being previously, it would seem, themselves the prosecutors, as the sheriffs were in their county-courts before the institution of procurators-fiscal; and, in the beginning of the next century, as the office of justiciar came into the hands of a single individual, so likewise did that of justice-clerk. The offices of justice-clerk and king's advocate (an officer of whom we have little account previously to the end of the fifteenth century) appear to have had at this time so many duties in common, that Henryson of Fordel, and Lawson of Hierigs, succeeded each other in them respectively; and the two offices having become vacant by the fall of those individuals at the fatal field of Flodden, Wischeart of Pittarrow was thereupon appointed to both places; but in his time a deputy began to be appointed to officiate as clerk to the Justice Court, Wischeart probably directing his chief attention to his duty as public prosecutor. On his death the offices of justice-clerk and king's advocate were again separated; and to the former Crawfurd of Oxengangs was appointed. On the institution of the present Court of Session, Crawfurd, then justice-clerk, was advanced, as were likewise the king's advocate, treasurer, and clerk-register, upon reasons of public policy; the deliberations of the court being at that time, and till the revolution, in secret with shut doors, agreeably to the practice of the papal tribunals, the principles of which, the court, as may be supposed from its ecclesiastical constitution, had very largely imbibed. The justice-clerk continued in this threefold character of clerk of the Justice Court (but discharging the duties by deputy), lord of Session, and public prosecutor, for some time, when he was at length superseded in the last capacity altogether by the lord-advocate; and in the degree in which he was so superseded he appears to have been appointed an assessor to the lord-justice-general, equally with the other lords of Session. In the time of the excellent Sir Robert Murray, who was appointed to the office in 1651, he began to be styled "lord-justice-clerk." In 1663, Sir John Home was appointed, and, the same year, declared by act of Privy Council a constituent judge of the Justice Court; and in 1672, a statute passed, constituting the lord-justice-clerk vice-president of the court, to preside in absence of the lord-justice-general.

In the Court of Session the justice-clerk had no pre-eminence, till the time of that distinguished lawyer, Miller of Barskimming, who, on his appointment, took his seat by desire of the court, on the right of the lord president; and on the division of the Court of Session into two chambers in 1811, the lord-justice-clerk was made *ex-officio* president of the Second Division, though he is not necessarily a lord of Session. (U. U. U.)

JUSTICES of the Peace, are persons of interest and credit appointed by the king's commission, to keep the peace of the county where they live.

JUSTICIAR, or JUSTICE-GENERAL OF SCOTLAND, officially the chief judge of the supreme criminal court of Scotland, but of old, as in England, the chief justice of the kingdom. The origin of this high office cannot, from the want of records, be traced. There can scarcely be a doubt, however, but that it was derived to us from England after the Norman conquest. The earliest notice we have of it is in the time of Malc. IV.; and then *two* justiciars appear, a justiciar of *Scotland*, and a justiciar of *Lothian*, or the territory subject to the king of Scots south of the Forth. Here, as in England, the justiciar was the king's chief officer, and at the head, not only of the *law* in all its departments, civil, criminal, and maritime, but also of the *military force* of the kingdom, *caput legis et militiæ;* and accordingly we find several instances of the martial prowess, as well as judicial authority, of the justiciar of Scotland in early times, particularly of the valiant justiciaries *Buchan* and *Durward*, in the middle of the thirteenth century. Durward, indeed, during his temporary removal from office, is known to have joined the standard of King Henry III. of England in the French campaign; and Fordun's character of him is more that of a gallant military officer than a sober gownsman.

In 1296, a single justiciar appears for the whole kingdom, in the person of Sir William de Ormesby, a justice of the Common Pleas in England, who was constituted by King Edward I. lord-justiciar of Scotland; but this appointment was of short continuance. In 1305, the English monarch having again put down the Scotch, distributed the kingdom into four districts, and appointed for each district two justices; an arrangement in which the English Justinian had certainly an eye to the judicial system of England, and to the introduction of justices in eyre or of assize, as delegates of the *aula regia*, or justice-deputes, such as were established in that country. The death of Edward, however, soon afterwards put an end to the project; and the old practice of having two justiciars was returned to, and continued till the time of King James IV., but under the designation of a justiciar *north of Forth*, and a justiciar of *Lothian*, or *south of Forth*.

Soon after the fatal battle of Flodden, in the beginning of the sixteenth century, the office of justiciar, or, as he was now styled, justice-general (in contradistinction to the special justices now frequently appointed, as well for particular places as for particular trials), came again into the hands of a single individual, viz. the Earl of Argyll, in which noble family it was hereditary for a century. The High Court of Justiciary, also, began then to be settled at Edinburgh; whereas, before, the parliament and superior courts were held chiefly north of Forth.

Towards the end of the same century, an alteration was made on the manner of going circuit. In the time of King Robert III., the justiciars were each required to pass twice in circuit through every shire of their jurisdiction. But by 1587, cap. 82, instead of passing through the realm from shire to shire successively, the realm was divided into four quarters, and two senators or advocates of the College of Justice were appointed as justice-deputes for each quarter. This system continued about a century, when, by 1672, cap. 16, instead of the former justice-deputes, certain lords of Session were constituted commissioners of Justiciary, along with the justice-general, and the justice-clerk was made vice-president of the court, to preside in absence of the justice-general; an arrangement which has continued to the present day.

The jurisdiction and the powers of the justiciar of England are known to have been distributed amongst the superior courts now existing there. The history of the powers possessed by the justiciar of Scotland we shall now notice. In England the justiciar became a formidable officer, a terror at once to the crown and the people. It does not appear that such was ever the case in Scotland. This no doubt arose much from the early partition of the office into a justiciary north and south of Forth. But his great adversary was the lord-chancellor, as the organ and instrument of the papal clergy, in whose hands the office of chancellor had here, as in the other countries of Europe, long been vested. The high office of justiciar was the envy of the ecclesiastics, always noted for their ambition; but it being forbidden them by the papal constitutions, as a secular tribunal and a place of blood, they could not directly seize upon it as they had done upon the office of chancellor. They therefore set about filching its jurisdiction; and in 1425 the first Court of Session was erected, composed of the chancellor, and with him "certaine discreete persones of the three estates," chosen by the king, with power to judge in all matters competent to the king and his council. In 1503, the Court of Daily Council was instituted instead of the Court of the Session; and at length, in 1532, the present Court of Session and College of Justice was established at Edinburgh, with a jurisdiction in all civil causes. From that time forward, the civil jurisdiction of the justiciar (whose office, it will be remembered, was now hereditary in the family of Argyll, and consequently feeble and inefficient) ceased. And not only so, but its relative importance expired, and the Court of Session became the supreme court of the kingdom; for, by clerical ability, or by lay subserviency not found in England, where the old common law has ever continued the antagonist of Roman jurisprudence, an act passed here (1540, cap. 72), requiring all sheriffs and other temporal judges to copy the proceedings (not of the justiciar, as heretofore, but) of the Court of Session. The triumph of the papal clergy was then complete; the old common law ceased; its records became obsolete, and are to this day of apocryphal authority; and the civil and canon laws became, what they were in use to be denominated, the *common law* of Scotland. And what the Court of Session effected in the civil jurisdiction of the justiciar, the Court of Admiralty did in its maritime jurisdiction. That court was little known before the end of the sixteenth century. About that time Mr Alexander King, advocate, was appointed judge of the Admiralty; and almost immediately, owing to the compilation of his *Treatise on Maritime Law* (perhaps the earliest regular work on that branch of jurisprudence in Britain), the Court of Admiralty rose to importance; and in 1681 it was declared a sovereign judicature, and the high-admiral, the king's lieutenant, and justice-general on the seas. In our own day, however, the High Court of Admiralty has been abolished, and the Court of Justiciary has re-acquired a criminal jurisdiction on the seas. As respects the military power once possessed by the justiciar, that departed from him long ago, and became vested in the army itself, superintended by the crown; yet to this day a recognition of the ancient power may be observed at the Justiciary circuits.

The supreme judicative power of Scotland is therefore now vested in the Courts of Session and Justiciary. The justice-general being now wholly nominal, and a sinecure, the chief judge of Justiciary is the justice-clerk, and the puisne judges are certain lords of Session. The justice-clerk is also president of the Second Division of the Court of Session, though, which is singular, he is not necessarily a lord of Session; and by a late act of parliament, the president of the Court of Session is, on the termination of the existing interest, to assume the office of justice-general. In effect, therefore, though in a very bungling and awkward sort of way the Court of Session will, on the act in question coming into operation, take the place and jurisdiction of the ancient justiciar. (U. U. U.)

JUSTICIARY, or COURT OF JUSTICIARY, in Scotland. See SCOTLAND.

JUSTIFICATION, in *Law*, signifies a maintaining or showing a sufficient reason in court why the defendant did what he is called to answer.

JUSTIFICATION, in *Theology*, that act of grace which renders a man just in the sight of God, and worthy of eternal happiness.

Different sects of Christians hold very different opinions concerning the doctrine of justification; some contending for justification by faith alone, and others for justification by good works.

JUSTIN, commonly called *Justin Martyr*, one of the earliest and most learned writers of the eastern church, was born at Neapoli, the ancient Sechem of Palestine. His father, Priseus, a Gentile Greek, brought him up in his own religion, and had him educated in all the learning of Greece. To complete his studies, he travelled to Egypt, and followed the sect of Plato. But one day walking by the sea side wrapt in contemplation, he was met by a grave person, of a venerable aspect, who, falling into discourse with him, turned the conversation by degrees from the excellence of Platonism to the superior perfection of Christianity, and reasoned so well, as to raise in him an ardent curiosity to inquire into the merits of that religion. The consequence of this inquiry was, that he was converted about the year 132. On his embracing the Christian religion, he quitted neither the profession nor the habit of a philosopher; but a persecution having broken out under Antoninus, he composed an *Apology for the Christians;* and afterwards presented another to the Emperor Marcus Aurelius, in which he vindicated the innocence and holiness of the Christian religion, against Crescens a Cynic philosopher, and other calumniators. He did honour to Christianity by his learning and the purity of his manners; and suffered martyrdom in the year 167. Besides his two Apologies, there are still extant his *Dialogue with Trypho*, a Jew; two treatises addressed to the Gentiles, and one on the unity of God. Other works are also ascribed to him. The best editions of St Justin are those of Robert Stephens, in 1551 and 1571, in Greek and Latin; that of Morell, in Greek and Latin, in 1656; and that of Prudentius Marandus, a learned Benedictine, in 1742, in folio. His works have also been published separately.

JUSTINIAN, the first Roman emperor of his name, and more celebrated for his code of laws than for the military achievements which distinguished his reign, was nephew of Justin I. and succeeded to the imperial purple on the death of his uncle in 527. He began his reign with the character of being a religious prince; and having published severe laws against heretics, and repaired ruined places of worship, he openly declared himself the protector of the church. But whilst thus engaged in re-establishing Christianity at home, he carried his arms against the enemies of the empire abroad, and, through his generals, proved so successful, that he in some measure reinstated it in its ancient glory. By means of Belisarius, the greatest captain of his age, the Persians were conquered, and the Vandals exterminated; Africa was regained; the Goths in Italy were subdued; the Moors were defeated; and the Roman empire was restored almost to its primitive glory. But, in the midst of these successes, the Emperor was endangered by a powerful faction at home; Hypalius, Pompeius, and Probus, nephews of the Emperor Anastasius, the immediate predecessor of Justin, raised an insurrection to dethrone him, and it required all the energy of Belisarius, seconded by Mundus, to put down the rebellion. This, however, was at length effected; the conspiracy was broken, and the ringleaders were capitally punished. The empire being now in the full enjoyment of profound peace and tranquillity, Justinian made the best use of it, by collecting the immense variety and number of the Roman laws into one body. To this end he selected ten of the most able lawyers in the empire, who, having revised the Gregorian, Theodosian, and Hermogenian codes, compiled one body, called *Codex Justinianus*. This may be called the statute law, as consisting of the rescripts of the emperors. But the reduction of the other part was a much more difficult task. It was made up of the decisions of the judges and other magistrates, together with the authoritative opinions of the most eminent lawyers, all which lay scattered, without any order, in no less than two thousand volumes. These were reduced to the number of fifty books; but ten years were spent in the reduction. The design was completed in the year 553, and the name of *Digest* or *Pandects* given to it. Besides these, for the use chiefly of young students in the law, and to facilitate that study, Justinian ordered four books of Institutes to be drawn up, containing an abstract or abridgment of the text of all the laws; and, lastly, the laws of a date posterior to that of the former were, in the year 541, thrown into one volume, called the *Novellæ*, or New Constitutions. See Civil Law.

This transaction has immortalised the name of Justinian, who, in other respects, was neither a great nor a good man, and whose name was held in abhorrence by the people, partly on account of his rash and inconsiderate conduct in ecclesiastical matters, but still more by reason of the heavy burdens which he imposed on them. He died suddenly in 565, after a reign of thirty-nine years, at the advanced age of eighty-three. Justinian built a great number of churches, particularly the famous St Sophia at Constantinople, which is esteemed a masterpiece of architectural design.

JUSTINIANI, St Laurence, the first patriarch of Venice, descended of a noble family, was born there in the year 1381. He died in 1485, leaving several religious works, which were printed together at Lyons in 1568, in one volume folio, with his life prefixed by his nephew. He was beatified by Clement VII. in 1524, and canonized by Alexander VIII. in 1690.

Justiniani, *Augustin*, bishop of Nebbio, one of the most learned men of his time, was descended from a branch of the same noble family with the preceding, and born at Genoa in 1480. He assisted at the fifth council of Lateran, where he opposed some articles of the concordat between France and the court of Rome. Francis I. made him his almoner; and he was for five years regius professor of Hebrew at Paris. He returned to Genoa in 1522, where he discharged all the duties of a good prelate; whilst learning and piety flourished in his diocese. He perished at sea in his passage from Genoa to Nebbio, in 1536. He composed several pieces, the most considerable of which is *Psalterium Hebræum, Græcum, Arabicum, et Chaldaicum, cum tribus Latinis interpretationibus et glossis.* This was the first psalter of the kind printed. There is also ascribed to this prelate a translation of Maimonides's *More Nevochim.*

JUSTINUS, a Latin historian, whose name appears in some manuscripts as M. Junianus Justinus, and in others, Justinus Frontinus. We are unable to fix with precision the period during which he flourished, though some have placed him in the reign of Antoninus, A. D. 160, from the name of that emperor being found in the dedication according to some manuscripts, though it is doubted whether this dedication be genuine. Of his private history we know nothing. Justin abridged the history of Trogus Pompeius, who wrote in the reign of Augustus. Its title runs thus: *Historiarum Philippicarum, et totius mundi originum et terræ situs ex Trogo Pompeio excerptarum, libri xliv. a Nino ad Cæsarem Augustum.* The first six books may be considered as an introduction to the history of Macedonia, which is found in books vii. viii. ix. xi.—xvii. xxiv.—xxvi. xxviii.—xxx. xxxiii. Justin tells us that he omitted every thing which he considered as either unnecessary or likely to be displeasing to the reader, and in this way he has passed over all the geograpical information of Trogus. He is particularly deficient in chronological arrangement, though his style is in general simple and correct. The Prologi which are found attached to each book were not written by Justin, but by some old grammarian. Editio princeps, Venet. 1470, per Jenson, and Rome, 1470, 1471. It has often been published along with Florus: Mediol. 1476; ed. Bongarsius, Par. 1581; ed. Lemaire, Par. 1823; e recen. Gron. et cum var. not. ed. Frotscher, Lips. 1827, 3 vols.

JUSTNESS, the exactness or regularity of any thing. Justness is chiefly used in speaking of thought, language, and sentiments. The justness of a thought consists in a certain precision or accuracy, by which every part of it is perfectly true, and pertinent to the subject. Justness of language consists in using proper and well-chosen terms; in not saying either too much or too little.

JUTERBOCK, a city of the circle of that name, in the Prussian province of Brandenburg, on the river Elbe, containing 569 houses, and 3394 inhabitants, employed in making cloth, leather, shoes, and linen goods.

JUTLAND, a large peninsula, which makes the principal part of the kingdom of Denmark. See DENMARK.

JUVENALIS, DECIMUS or DECIUS JUNIUS, a celebrated Roman satirist, respecting whose personal history only a few scanty notices have been preserved, chiefly in a life of the poet usually ascribed to Suetonius. Juvenal was a native of Aquinum, now Aquino, a city of Latium, on the Via Latina, a few miles from the left bank of the Liris; but whether he was the son of a freeman by birth or by adoption, is a point which cannot now be decided. Neither is the exact date of his birth or death known, though it seems most consonant to the other facts stated respecting him, to conclude that he must have been born about A. D. 42, in the reign of the Emperor Claudius. Some have believed him to have been the pupil of Quintilian, and Fronto, the preceptor of the two Antonines; but the time during which they flourished disproves this supposition. Juvenal seems to have pursued in his early years the study of rhetoric with much ardour, more as a recreation than with the view of employing it in the practical affairs of the forum; and it was not until he was far advanced in years that his genius for poetry fully developed itself. It is said that a passage in one of his Satires (vii. 87–92), which lashes with an unsparing hand the court of Domitian, was thought by the favourite of the day to aim indirectly at the conduct of Hadrian; and the emperor marked his displeasure by banishment from Rome to the most remote district of Egypt, though under the pretext of an appointment as *præfectus cohortis.* He had now reached his eightieth year, A. D. 121, and his age was not suited to bear a change of climate or the fatigues of a camp. He is said to have died in Egypt, though some make him return to Italy.

Of the works of Juvenal we possess a collection of sixteen satires, divided by grammarians into five books. The last satire is considered by some as not being the production of Juvenal. They were not written and published in the same order in which we now possess them. The character of the Satires of Juvenal is very different from that of the Satires of Horace. Whilst Horace laughs in a good-natured tone at the follies of mankind, Juvenal pursues their crimes with all the unmitigated bitterness of scorn. The picture which he at times presents is so hideous, that the mind revolts at its contemplation; and it is impossible not to believe but the same effect might have been produced if the poet had been somewhat less minute in his details. The corruption of manners which had at this time pervaded every class of the Romans, was certainly of the most revolting kind, and supplied ample materials for the pen of the satirist. Yet there is an exaggerated tone, and an air of rhetorical declamation, throughout his satires, which lessen greatly their effect. This is also the fault to be found with all the writings of his age, produced evidently by a desire of astonishing the imagination with bold and novel descriptions. The first edition of Juvenal was probably that published along with Persius, at Rome, 1470. The best is that of Ruperti, Lips. 1801, which has often been reprinted. It has been translated into English by Holyday, Oxf. 1616, 1673; by Stapleton, six Satires, Oxf. 1644; by Dryden, Lond. 1697; by Owen, Lond. 1785; and by Madan, Lond. 1789. The best translation into French is said to be that of Dusaulx, Paris, 1770, 1816, 5th ed., or of Raoul-Rochette, Paris, 1812.

JUVENCUS, CAIUS VECTICUS AQUILINUS, one of the first of the Christian poets, was born of an illustrious family in Spain. About the year 320 he put the life of Jesus Christ into Latin verse, of which he composed four books. In this work he followed closely the text of the evangelists; but his verses are written in bad taste and in worse Latin.

JUVENTAS, in *Mythology*, the goddess who presided over youth amongst the Romans. This goddess was long honoured in the capitol, where Servius Tullius erected a statue to her. Near the chapel of Minerva there was the altar of Juventas, and upon this altar a picture of Proserpine. The Greeks called the goddess of youth Hebe; but it has been generally supposed that this was not the same with the Roman Juventas.

JUXON, DR WILLIAM, archbishop of Canterbury, was born at Chichester in 1582. He was educated at Merchant Tailors' School, and thence elected into St John's College, Oxford, of which he became president. King Charles I. made him bishop of London, and in 1635 promoted him to the office of lord high treasurer of England. The whole nation, and especially the nobility, were greatly offended at this high office being given to a clergyman; but he behaved so well in the administration, that he soon put a stop to all the clamour raised against him. This place he held no longer than the 17th of May 1641, when he prudently resigned the staff, to avoid the storm which then threatened the court and the clergy. In the following February an act passed, depriving the bishops of their votes in parliament, and incapacitating them from exercising any temporal jurisdiction. In these leading steps, as well as in the total abolition of the episcopal order which followed, he was involved with his brethren; but neither as a bishop nor as a treasurer was a single accusation brought against him in the long parliament. During the civil wars he resided at his palace at Fulham, where his meek, inoffensive, and affable manners, notwithstanding his remaining steady in his loyalty to the king, procured him the visits of the principal persons of the opposite party, and respect from all. In 1648 he attended his majesty at the treaty in the Isle of Wight; and, by his particular desire, waited upon him at Cotton House, Westminster, the day after the commencement of his trial, during which he frequently visited him in the office of a spiritual father; and his majesty declared he was the greatest comfort to him in that afflicting situation. He likewise attended his majesty on the scaffold, where the king, taking off his cloak and george, gave him the latter. After the execution, Bishop Juxon took care of the body, which he accompanied to the royal chapel at Windsor, and stood ready, with the common-prayer book in his hands, to perform the last ceremony for the king; but he was prevented by Colonel Whichcot, governor of the castle. He continued in the quiet possession of Fulham Palace till the ensuing year, 1649, when he was deprived, having been spared longer than any of his brethren. He then retired to his own estate in Gloucestershire, where he lived in privacy till the restoration, when he was presented to the see of Canterbury; and, during the little time he enjoyed it, expended, in buildings and reparations at Lambeth Palace and Croydon House, near L.15,000. He died in 1663, having bequeathed L.7000 to St John's College, and to other charitable uses near L.5000. He published a sermon on Luke, xviii. 31, and Some Considerations upon the Act of Uniformity.

K.

K, the tenth letter, and seventh consonant, of our alphabet, being formed by a guttural expression of the breath through the mouth, together with a depression of the lower jaw, and an opening of the teeth. Its sound is much the same with that of the hard *c*, or *qu*, and it is used for the most part only before *e*, *i*, and *n*, in the beginning of words, as *ken*, *kill*, *know*, and the like. It used formerly to be always joined with *c* at the end of words, but is at present very properly omitted, at least in words derived from the Latin. Thus, for *publick*, *musick*, we now say *public*, *music*, and so on. However, in monosyllables it is still retained, as *jack*, *block*, *mock*, and the like.

K was borrowed from the Greek *kappa*, and was but little used amongst the Latins. Priscian looked on it as a superfluous letter, and says that it was never to be used except in words borrowed from the Greek. Dausquius, after Sallust, observes that it was unknown to the ancient Romans. Indeed we seldom find it in any Latin authors, excepting in the word *kalendæ*, where it sometimes stands instead of *c*. Carthage, however, is frequently spelt on medals with a K, SALVIS AUG. ET CAES. FEL. KART.; and sometimes the letter K alone stood for *Carthage*. M. Berger has observed, that a capital K, on the reverse of the medals of the emperors of Constantinople, signified *Konstantinus;* and that on the Greek medals it signified ΚΟΙΛΗ ΣΥΡΙΑ, *Cœle-Syria*. Quintilian tells us, that in his time, some people had a mistaken notion, that wherever the letters *c* and *a* occurred at the beginning of a word, *k* ought to be used instead of the *c*. Lipsius observes, that K was a stigma anciently marked on the foreheads of criminals with a red-hot iron.

The letter K has various significations in old charters and diplomas; for instance, KR. stood for *chorus;* KR. C. for *cara civitas;* KRM. for *carmen;* KR. AM. N. for *carus amicus noster;* KS. *chaos;* KT. *capite tonsus*, &c. The French never use the letter *k* excepting in a few terms of art and proper names borrowed from other languages. Ablancourt, in his dialogue of the letters, introduces K as complaining that he has been often in a fair way of being banished from the French alphabet, and confined to the countries of the north.

K is also a numeral letter, signifying 250, according to the verse,

> K quoque ducentos et quinquaginta tenebit.

When it had a stroke above it, $\bar{K}$, this letter stood for 250,000. K on the French coinage denotes money coined at Bordeaux.

KAARTA, one of the many kingdoms into which the western part of Africa is divided, and of which little or nothing is known, excepting that it is of considerable extent, but, from the arenaceous nature of the soil, very scanty in all vegetable productions, with the exception of the lotus. The capital is called Kemmoo; but the king has, besides, two strong fortresses, Joko and Gedingooma, to which he can flee for security when his dominions are invaded by the forces of the neighbouring states. Kasson, formerly an independent country, is now incorporated with Kaarta. It is about fifty miles from north to south, and nearly the same from east to west; but, though small, it is well peopled, and is a beautiful and fertile country. Kasson is likewise considered as rich in gold, silver, and coffee. The capital is called Kooniakary. The commerce of the states in this quarter consists in exchanging gold, ivory, and slaves, for European goods.

KABANIA, a fortress of Asiatic Russia, being part of the line formed for the defence of the government of Tobolsk. There are seventy-five houses without the fort. It is 270 miles south of Tobolsk.

KABANOUA, or KABANOUSKA, a fortress of Asiatic Russia, in the government of Tomsk, for protecting the frontier against the Kirghises. It is eighty-six miles south of Tomsk.

KABARDA, a territory of Asia, in the Russian government of Caucasus, inhabited by the principal of those nations known under the name of Circassians. The Terek, along the southern bank of which it extends, separates it from the Russian government of Caucasus. It is divided into the Great and Little Kabarda, the frontier of which reaches from the shore of the Caspian to the river Malka, whilst the latter extends thence to the environs of the city of Mosdok. They are both subject to Russia, but they are governed internally by their own princes.

KABOUR, a river of Asia, in the pashalik of Bagdad, which rises near Merdin, and pursues a southerly course, until it receives the Mygdonius, when it enters the Euphrates at Kerkesia, the ancient Circessium.

KABRONANG, an island in the Eastern Seas, about eighteen miles in circumference. It is in a high state of cultivation, and may be seen about eighteen leagues off, being distinguished by a high-peaked hill about the middle. It is separated from Salibabo island, which lies to the north-west, by a strait about four miles wide. Long. 126. 35. E. Lat. 3. 50. N.

KACHTAN, or CACHTAN, a small district of Yemen, in Arabia, situated in a mountainous district, about six days' journey north-north-east from Saade.

KADESH, KADESH-BARNEA, or EN-MISHPAT, in *Ancient Geography*, a city celebrated for several remarkable events. At Kadesh, Miriam the sister of Moses died; and here it was that Moses and Aaron, showing a distrust in God's power, when they smote the rock at the waters of strife, were condemned to die without the consolation of entering the promised land. The king of Kadesh was one of the princes killed by Joshua. This city was given to the tribe of Judah, and was situated about eight leagues to the south of Hebron.

KADIRGUNGE, a town of Hindustan, in the province of Agra, and district of Furruckabad, surrounded by a mud wall. It is situated near the south-west bank of the Ganges, and forty-three miles north-north-west from Furruckabad. Long. 79. 2. E. Lat. 27. 50. N.

KADMONÆI, or CADMONÆI, in *Ancient Geography*, a people of Palestine, said to have dwelt at the foot of Mount Hermon, which lies to the eastward, and is the reason of the appellation, with respect to Libanus, Phœnicia, and the northern parts of Palestine. They were also called *Hevæi*.

KADOM, a city of European Russia, in the province of Tambow. It is situated in a woody district, mostly inhabited by Tartars. The population amounts to 5100 persons.

Much wax and honey is collected in the neighbourhood. It is 230 miles east-south-east from Moscow.

KAFFA, a city of the Russian empire, in Europe, in the Crimea. It was formerly the capital of that peninsula, and the residence of the khan; and, from the end of the thirteenth till the middle of the fifteenth century, it maintained, by its flourishing trade, which was chiefly with Genoa, a population of 100,000. It was taken by the Turks in 1474, since which time its trade has vastly declined. It was taken by the Russians in 1770, and given back again to the khan in 1774. But it was, with the whole of the Crimea, given up to Russia in 1783, which cession was confirmed by the treaty of 1792, concluded at Jassy, between Turkey and Russia. It stands on a bay of the Black Sea, on the side of a hill. It was declared a free port by the Russians in 1798. It is the seat of the provincial government, has some trade in the products of the soil of the peninsula, and contains 5000 inhabitants. There is a Greek theatre, a botanic garden, and a museum of antiquities, established in the neighbourhood. It is sometimes called by the Russians Feodosia.

KAFFILAR KOOK, a village of Persia, surrounded by a range of high mountains of the same name, on the road from Sultania to Sennah, and seventy miles north-north-east of the latter place.

KAFFRARIA, Kafferland, or Caffraria, a territory extending along the eastern shores of South Africa, from the eastern boundary line of the Cape of Good Hope to Delagoa Bay, a distance of between 600 and 700 miles. It extends inwards to the country of the Boshuanas, between 200 and 300 miles from the sea; but this frontier has never been properly explored, and consequently cannot be correctly defined. To this coast the Portuguese gave the name of Natal, which has been followed by navigators, but is of course not in use amongst the natives as a designation of their territory. Of this region of the globe, either as regards its physical aspect or natural productions, little is known, and that little is confined to isolated parts, and not to the country as a whole. In some portions of it sandy plains spread out in unfruitful barrenness for many miles; but others are exceedingly fertile, consisting of fine savannahs, intersected with small clumps of trees, and carpeted with a rich variety of herbaceous plants, whilst excellent streamlets, meandering amongst the shrubbery in the centre of the valleys, give life and beauty to the landscape. These are chiefly to be met with at the base of a chain of high mountains stretching into the vicinity of Delagoa Bay. The ridge was recently crossed by one of the missionaries resident in this quarter, who says, that on reaching the summit, fine grassy plains, thickly inhabited, were seen spreading out in every direction, it being the summer residence and grazing-place of those clans who live along the base of the mountain. The pasturage was good and abundant, the climate remarkably fine, and the general aspect of the country, the trees, and shrubs, and other features, strikingly resembled those in many parts of England, whilst the whole appeared watered by numerous rills. The mountainous range which divides the sea-border from the interior is in some parts 6000 feet in height; and the most distinguishing geological feature which they possess is the presence of a superincumbent stratum of sandstone. High detached masses are found in many places standing some feet above the surface of the earth. The upper part of a mountain visited by the individual alluded to, presented to the eye immense precipices capped with large rhomboidal tables, and projecting angles forming a sort of cornice to the face. On the side of the declivities there was a description of prismatic quartz crystals in a corroded state, and evidently undergoing the process of decomposition; a circumstance which is observable in all the mountains of South Africa, and will no doubt yearly give rise to an increasing extent of soil. Iron-stone is everywhere found in Kaffraria, and also considerable quantities of ochre of various kinds, presenting itself under different circumstances. The coast of Natal has been described by one of the most recent authorities as looking like a large park, varied with hill and dale, displaying occasionally through a luxuriant valley the distant prospect of blue mountainous ridges. On other parts of the coast the landscape was equally beautiful; clusters of trees, hills, vales, and glens composing the foreground, whilst in the distance, divided by a deep valley or chasm, a range of craggy mountains extended in a parallel direction to the limits of vision. There are a great many rivers on the Kaffraria coast, of which the Kaï or Ky, and Keiskamma, are amongst the largest. The entrance of the former is one of the most picturesque and extraordinary in the world, as it forms, by its abrupt and perpendicular heights, a natural lock, "wanting only a flood-gate to make it a wet dock." That part of the coast where Port Natal is situated possesses so many advantages, that proposals have been lately made to the British government to have it regularly settled. The memorial of the merchants and other inhabitants of the Cape of Good Hope embodies various reasons for laying the case before the "king in council;" and as it likewise conveys a description of the country, we shall give an abstract from it.

The arguments brought forward are, that the country in the vicinity of Port Natal was originally purchased by the Dutch, and held by them as a dependency of the Cape of Good Hope, and, of course, along with the latter colony, was ceded to Great Britain in 1814; that since the year 1824, Port Natal has been almost constantly occupied by British subjects, by permission of the governor of Cape Colony; that these persons had succeeded in opening a trade with the natives, which has gradually increased in extent, from the encouragement offered by the Zoolas, who are favourable to Europeans, but whose residence there is attended with great risk in the absence of a government establishment, which would be a protection to the trader, and likewise prevent the frequent collision of the Zoola and Kaffre tribes. The pastures of the country between these tribes are of a highly favourable description. It is well wooded with large timber, and watered by upwards of one hundred rivers and running streams, some of which are larger than the chief rivers of Cape Colony. The soil is fertile, and has produced three crops of Kaffre and Indian corn in the year. The rains are periodical, and the climate is cooler than that of the Cape, and highly salubrious. The bay of Port Natal is an exceedingly fine harbour, but the entrance is narrow, and has a bar of shifting sand. There are six feet of water on the bar, with a run of six feet, and at spring-tides the depth is fourteen. "There are a considerable number of natives, a laborious and well-conducted people, who are the remains of the tribes who formerly occupied the country purchased and ceded by the Dutch, and who, having attached themselves to the white inhabitants, are living in its vicinity under their auspices, unmolested by the Zoolas." The memorial goes on to state, that such an establishment as that contemplated would prevent the irregular trading which is carried on at Port Natal, and advance the civilization and moral improvement of the neighbouring tribes, besides protecting the Kaffres. The ceded territory is said to extend about two hundred miles along the coast to the westward, and one hundred miles inland; and, from the capabilities of the country for maintaining a large population, and carrying on an extensive trade, a comparatively small military force is all that is required.

The name Kaffre (in Arabic Kafir, signifying an unbeliever or pagan) was given by the early Portuguese navigators to the natives of the entire eastern coast of Africa. The

Kaffraria. Dutch settlers at the Cape, therefore, when, in their migrations eastward, they discovered a race of men entirely different from the Hottentots, called them Kaffres. This name, in its most extensive application, designates several African tribes, who are again distinguished by other appellations; and colonial usage has almost appropriated the generic term Kaffre to the tribe in closest contact with the colony, and who call themselves Amakósa. Their northern neighbours are called the Amatêmbu, which the Dutch have metamorphosed into Tembooger, and the English into Tambookies. Farther east is located the Amaponda or Amambo, which has been corrupted into Mambookies. The latter are the most industrious of the three nations, but the Amakósa are considered the most warlike. Still farther to the east of the Amaponda are the Zoolas, to whom reference has already been made. The descent of these races of men has been attributed to the Bedouins or wandering Arabs; and this conjecture is by no means improbable, for they are distinct from both negroes and Hottentots; whilst the people above mentioned, having penetrated into every part of Southern Africa, may have reached this country by skirting the Red Sea, and journeying southward by the sea-coast, so as to avoid the great desert of sand by which Africa is divided into two parts. Their character, manners, modes of building, and other circumstances, also favour the assumption. The middle of the seventeenth century has been assumed as the period when they first acquired territory here from the native tribes. The Amakósa Kaffres have been frequently described by individuals who have visited their country. Their features are Asiatic, their physical endowments considerable, and their intellectual qualities respectable, although, from their remaining still in an uncivilized, and almost entirely savage state, the latter have not had a fair opportunity of developing themselves. But we shall recur to the subject of their character and future prospects at the close of this article.

One of the principal articles of trade amongst the Kaffres is the barter of cattle for young women of the Tambookie tribe, who are short, stout, and muscular; and these are preferred by the chiefs to females of their own people. In the warm season a thin apron constitutes their sole bodily attire; but in winter a cloak is used, made of the skins of wild beasts, admirably curried. The head, even in the hottest weather, is never protected by any covering; and they seldom use shoes, except on undertaking a long journey, when they condescend to wear a rude substitute for them. The bodies of both sexes are tatooed; and those of the young men who correspond to the fops of more civilized nations paint their skins and curl their hair. Their arms are the javelin, a large shield of buffalo hide, and a short club. The women exhibit taste in the arrangement of their dress, particularly for the head, which consists of a turban made of skin, and profusely ornamented with beads. A mantle of skin, variously bedecked with beads and other showy trinkets, is worn; and the only distinction between the dress of the chieftain's wives and those of the lower ranks consists in the greater profusion of ornaments possessed by the former, but of which all are alike vain. There is no change, the whole wardrobe of the female being that which she carries about with her, and sleeps in; for bed-clothes they have none. Their huts are generally about twelve feet diameter, with a raised floor, and a gutter for a drain. They are constructed by setting up poles erect, then bending the tops till they meet, when they are tied together with fibres. This skeleton of a dwelling is then thatched outside with rushes, and plastered inside with clay or cow dung. Little time is spent in these primitive abodes, for the excellence of the climate admits of the people living much in the open air. The Kaffre hamlet generally consists of about a dozen of such huts; and the sites of these, as well as the cattle folds, are chosen with reference to the pasturage ground, as the safety and multiplication of their flocks is the chief care of these modern Arcadians. Horses have lately been brought amongst them, previous to the introduction of which the ox was their only beast of burden. Sheep and goats have greatly multiplied with them.

The grain which they chiefly cultivate is a kind of millet, *holcus sorgium;* a small quantity of Indian corn, and some pumpkins, are likewise grown; but a species of sugar-cane called mifi is produced in great abundance, and of this they are extremely fond. Their diet, however, is chiefly milk in a sour, curdled state. They abhor swine's flesh, keep no poultry, are averse to fish, but indulge in eating the flesh of their cattle, which they prepare in a very disgusting manner. They are nearly strangers to spirituous liquors, but have as substitutes a kind of mead, and a tolerably good beer prepared from malted millet. Although naturally brave and warlike, they prefer an indolent, pastoral life, hunting being an occasional pastime. They are excellent herdsmen, and extremely expert in the management of their oxen, which they train to obey with perfect docility the will of their masters. They are carefully sheltered and secured in pens, and milked morning and evening in their folds. The hides are made into garments by the men, who also exhibit some dexterity as artisans in fashioning weapons, axes, and the like. The women, however, officiate as the architects of the dwellings; and they also weave a superior sort of mat from a fine rush, which displays some taste in the execution. Their whole household utensils consist of a sleeping mat, a leathern milk sack, a calibash, and an earthen pot for cooking.

Their form of government is that of hereditary chieftains, or clansmen. The chiefs are legislators as well as judges, but the old men of the tribe assemble on necessary occasions, forming a sort of jury, and they have also a voice in decisions, which are generally founded on precedents, orally and faithfully transmitted from sire to son. Their laws are few and simple. The courts, which all have the privilege of attending, are held in the open air, and each party to a suit pleads his own cause. In their religion, although no regular system of idolatry exists amongst them, they are addicted to sorcery, spells, and charms. They reverence a Supreme Being, and believe in the immortality of the soul, yet never associate with it the idea of future rewards and punishments. With the exception of a few unimportant matters connected with the burying of the dead, their religious or solemn ceremonies present nothing worthy of particular notice.

Much light has recently been thrown on the present condition and future prospects of this people, by papers relative to the Cape of Good Hope, which were laid before government in 1835. From these it appears that a system of aggression, and an unjustifiable appropriation, on the part of the whites, have from time to time roused the savage energies of the Kaffres, and impelled them to make severe reprisals on their European spoilers. The longing of the colonists for the well-watered valleys of the Kaffres, and of the latter for the colonial cattle, which are much superior to their own, still are, as they have always been, the sources of irritation. The Dutch boors, an unscrupulous race of men, seem from time to time to have treated the aboriginal population very unceremoniously. In the year 1834, matters arrived at a crisis. A portion of land on the western side of the Keiskamma had, for many years, been occupied by the herds of the Kaffres, by permission of the colonial government. This indulgence was said to have been abused, and the immediate expulsion of the transgressors took place. This happened in November 1833. The Kaffres retaliated, and, at the close of 1834, the depredations in the colony had reached an alarming height. The savages poured into the colony in great numbers, wasted the farms, drove off the cattle, and murdered not a few of the inhabitants. An army of 4000 men was marched against the invaders, who were driven far beyond the boundary line which formerly separated Kafferland from Cape Colony, and not only forced them to confine themselves within the new limits prescribed, but to pay a heavy fine. Treaties have been entered into between some of the native chiefs and the colonial government, by which the river Ky is constituted the boundary of the colony; an arrangement which deprives the Amatêmbu people, who did no harm, of their independence. Tracts of country have been assigned to the Kaffre chiefs of several families, who acknowledge themselves to be subjects of Great Britain, and who are to pay a fat ox annually as a quit-rent for the lands which they occupy. They are now, so far at least, brought within the pale of the English government; but how the plan will succeed is still a matter of uncertainty and speculation. (For further particulars on this subject, see *Edinburgh Review*, vol. lxiii.)

KAHLORE, a Sikh town of Hindustan, in the province of Lahore, situated on the banks of the Sutlege, above Macowall, and near the mountains through which that river enters Hindustan. There is also a town of this name situated at a short distance north-east from the city of Lahore.

KAIBALLS, a people of Asiatic Russia, who reside near the source of the Yenesei. They appear to be an intermixture of the Samoyeds with the Tartar race.

KAINSI, the Hottentot name of a species of antelope, denominated by the Dutch, on account of its agility, *klip-springer.* It is of a yellowish-gray colour, and of the size of a kid of a year old.

KAINSKE, a small fortified town of Asiatic Russia, in the government of Tomsk, situated on a small river of the same name. It is placed as a defence to the Tartars of the steppe of Barabinsk, against the incursions of the Kalmucks and Kirghises.

KAIR, a large fortified town of Hindustan, in the province of Aurungabad, situated on the south bank of the Godavery.

KAIRWAN, a city of Africa, in the province of Tunis, the first seat of Saracenic empire in Barbary, and still ranking second only to Tunis in trade and population. It is a walled town, situated in a barren sandy plain, and dependent for its supply of water upon a capacious reservoir, filled by the rains, and a pond which becomes nearly dry in summer, when it exhales a noxious effluvium. The situation is undoubtedly ill chosen, yet it appears to occupy an ancient site, and it derives importance from its situation. Shaw, in his *Travels*, gives the following account of it. "We have at Kairwan several fragments of ancient architecture; and the great mosque, which is accounted to be the most magnificent, as well as the most sacred, in Barbary, is supported by an almost incredible number of pillars. The inhabitants told me (for a Christian is not permitted in Barbary to enter the mosques) that there are no fewer than five hundred. Yet among the great variety of columns, and other ancient materials, that were employed in this large and beautiful structure, I could not be informed of one single inscription." The name which it bears seems to be the same with *caravan*, and might therefore originally designate the place where the Arabs had their principal station in subduing this portion of Africa. It was founded by Hucba or Akbar, in the fiftieth year of the hejira, "under the modest title," says Gibbon, "of the station of a caravan." The population is said to amount to above 50,000. Long. 9. 57. E. Lat. 35. 36. N.

KAISERSLAUTERN, a city of Bavaria, the capital of the district of the same name, in the province of the Rhine. The district extends over 706 square miles, and contains 98,400 inhabitants. It is in a mountainous country, filled with mines, and a great part covered with woods. The city is situated on the river Lauter, and is surrounded with walls, containing three churches, 380 houses, and 2810 inhabitants. There are manufactories of cotton goods and hosiery, and several blast-furnaces. It is remarkable for three battles fought there between the Prussians and the French, one in 1793, the other two in 1794. Long. 7. 41. E. Lat. 49. 26. N.

KAJAAGA, or GALAM, a kingdom of Western Africa, extending from within a few miles of the Cataract of Feloo in the east (where it is bounded by Kasson), about forty miles west of the Falume, to the north of Geereer Creek, which divides it from Foota. On the south it is bounded by Bondoo. The most complete description of this country is that contained in Major Gray's *Travels in Africa*, who visited it in 1819. At that time Kajaaga was composed of a series of towns situated on either bank of the river Senegal. It formerly extended several miles in the direction of Bondoo, Foota, and Bambouk, but had shrunk into its present dimensions in consequence of the encroachments of the neighbouring tribes, with whom a war was kept up, and who were enabled to carry it on more successfully from disagreements amongst the various branches of the royal family. The river Fa-lemmê (which signifies "small river") divides it into Upper and Lower Kajaaga. The former is governed by the Tonca of Maghana, and the latter by the Tonca of Tuabo. These towns constitute the capitals of the respective divisions, but neither acknowledge the supremacy of the other, although previously and of right it belonged to the former, near which is situated Fort St Joseph, now deserted and in ruins. This was the point at which the French attempted to carry on the commerce of the Upper Senegal, and a voyage thither was calculated to realize cent. per cent.; but the unhealthiness of the climate, the difficulties of the navigation, and the constant hazard of being plundered by a succession of barbarous chiefs, who occupy the banks, render it a very precarious speculation. The Serawoollies, who are located in this quarter, rank amongst the most industrious of the African tribes, and have engrossed the trade of Bambouk, Manding, and most of the upper districts of the Senegal as well as the Niger.

The face of the country is very mountainous, and covered to a considerable extent with wood, a large portion of which is well adapted to common uses. The vegetable productions, like those of Bondoo, are corn of four different kinds, together with rice, pumpions, water melons, gourds, sorrell, onions, tobacco, red pepper, pistachios, cotton, and indigo. Numbers of tamarinds, baobabs, rhamnus lotus, and other fruit-trees, are likewise scattered about the beautiful and picturesque valleys. This country differs from Bondoo only in its proximity to the river, and in its partial inundation during the rains. The commerce consists in the exchange of the cotton cloths manufactured in the country, and the superabundance of their provisions, for European merchandise, such as fire-arms, gunpowder, India goods, hardware, amber, coral, and glass beads. These are again exchanged with their neighbours of Kaarta, Kasson, and Bambouk, for gold, ivory, and slaves, who are in their turn sold to vessels from Senegal. The manufactures of Kajaaga are nearly similar to those of the neighbouring kingdoms, consisting of wearing apparel, household furniture, together with implements of husbandry, carpenters', blacksmiths', and leather-workers' tools, and knives, spear and arrow heads, bridle-bits, stirrups, and a variety of other small articles. But they have an advantage over their neighbours in some respects, particularly in the weaving and dyeing of cotton; "and," Major Gray observes, "whether it be that the humidity of the soil on the banks of the river is more congenial to the growth of the cotton and indigo, or that the manufacturers are more expert, I cannot say; but certain it is, that they can dye a much finer blue than I have before seen in Africa." The dress of the people is far from being inelegant or inconvenient. The men wear on the head a white cotton cap, very neatly worked with different coloured silks or worsteds; whilst a shirt of white cotton, with short sleeves, worn next the skin, covers the body from the neck to about the thigh, and is surmounted by a very large one of the same materials, descending below the knees, as do also the small clothes, which are very roomy above, and generally of a blue colour. They wear their hair cut close; and the cap, which is always white, is of a very graceful form, and embroidered. The dress of the women, who are extremely neat in their persons, is handsome; and they are very fond of such ornaments as amber, coral, and glass beads of different colours, wherewith they bedeck different parts of their bodies. In their living they are proverbially fond of animal food; indeed a putrid hippopotamus floating down the Senegal is considered as a prize, the division of which, when dragged to shore, sometimes occasions strife amongst the captors. From a state of paganism, these people are gradually veering round to the tenets of Mahommed. Some towns are wholly inhabited by priests, who are by far the most wealthy and respectable members of the community. There is a mosque in every town, and the times of worship are strictly attended to by the priests and their disciples. Great numbers of dates are grown in all the towns, which are beautifully shaded with large trees of the fig and other kinds of timber; and being well walled, present a more respectable appearance than might be expected amongst a people whose means are so limited. In their persons they are rather robust, and of a grave and sober deportment. Their colour is a jet black, which they are at much pains to preserve, by profusely anointing their bodies with rancid butter. They are considered as more friendly to Europeans than any other of the surrounding tribes, probably from the long existence of a state of commercial intercourse between them and the inhabitants of Senegal, with whom they claim relationship, and towards whom they show much attachment. The advantages which they derive from their local situation render them enemies to the people of Bondoo, who have nothing to do with the river except through the medium of the Kajaaga country. Hence the exertions which have been made by Bondoo to subjugate the nations, and kindle up intestine warfare between the inhabitants of the upper and lower states; and this to a certain extent they have succeeded in effecting. But with these barbarous races of men, amongst whom war is a regular trade, and moral restraint can be but imperfectly recognised, there is such a continual fluctuation of affairs, that it is hazardous to assign limits to the territory which they possess, or to say what the form of government is at any given time; for the predatory inroad of a neighbouring foe may totally alter both in the course of a single day. According to Major Gray's account, the succession to the crown is not hereditary, but descends in a regular line to the eldest branch of a numerous race called Batcheries, who are the undisputed chiefs of the country. The population was considerably increased by an influx of inhabitants from the north bank of the river, who were obliged to quit their own country on account of the exorbitant demands of the Kaartans, to whom they paid tribute. But what the total amount may at present be it is impossible to form a conjecture.

KAKETI, the most easterly and mountainous province of Georgia, in Asia, the surface of which is covered with the ruins of fortresses, villages, and towns, owing to the numerous wars, both foreign and domestic, to which it has been exposed. It is now subject to the dominion of Russia, having been formerly governed by its own princes. Some degree of order has been restored under the rigorous rule of Russia, and both commerce and population are extending.

KAKKABBAN, an island in the Eastern Seas, and one of the cluster called Maratuba, forty miles from the east coast of Borneo. Long. 116. 40. E. Lat. 2. 8. N.

KAKORH, a large town of Hindustan, in the province of Ajmeer, situated at the southern extremity of a range of hills.

KAKREZE, a district of Hindustan, in the province of Gujerat, which consists of eighty-four villages, belonging to several Hindu chiefs. Its principal towns are Therah and Oon, at the latter of which the district commences. Kakreze is fifteen miles to the north of Rahdunpoor.

KALAMATA, a town of Greece, in the Morea, the capital of a circle of the same name. It stands at the mouth of the river Pirnascha, on the Gulf of Koron, and contains 2500 inhabitants, partly employed in the fishery, and in cultivating olives.

KALASIN, a city of the province of Twer, in Russia, the capital of a circle of its own name, which contains one city, 650 villages, and 64,210 inhabitants. The city stands at the mouth of the Chabna, where that river falls into the Volga. It contains 640 houses, and 3820 inhabitants. Long. 38. 38. E. Lat. 57. 20. N.

KALATIGAS, a small river of the island of Java, near its eastern extremity. It is the termination of the fine military road made by order of General Daendels, the French governor, and which extends in length from Batavia 684 miles.

KALATOA ISLE, an island in the Eastern Seas, about thirty miles in circumference, surrounded by a cluster of other islands or rocks, on which the English ship the Ocean was lost in 1797. Long. 122. 15. E. Lat. 7. 18. S.

KALBE, a city, the chief place of a circle of the same name, in the province of Saxony, in Prussia, and situated on the river Saale. It is celebrated for its manufactures of friezes, flannels, and hosiery. It is fortified, and contains 781 houses, with 4427 inhabitants. Long. 11. 39. 1. E. Lat. 51. 54. 52. N.

KALDER DAG, a lofty range of mountains in Asia Minor, extending eastward from Osium Kara Hissar to beyond Ak Shehr.

KALEIDOSCOPE.

KALEIDOSCOPE, an optical instrument, invented by Sir David Brewster, which, by a particular arrangement of mirrors, or reflecting surfaces, presents to the eye, placed in a certain position, symmetrical combinations of images, remarkable for their beauty and the infinite variations of which they are susceptible. The name is derived from the Greek words καλος, *beautiful*, ειδος, *a form* or *appearance*, and σκοπεω, *to see*.

History of the invention.

The effect of combining two or more plane mirrors, so as to produce a multiplication of images, had long been known and described by writers on optics. Baptista Porta, in his *Magia Naturalis*, gives an account of the construction of an instrument, which he calls *polyphaton*, in which two rectangular specula are united by two of their sides, so that they may be opened or shut like a book, and the angles varied; and also of a polygonal speculum, consisting of several mirrors arranged in a polygon, for multiplying in different directions the images of ob-

Kaleidoscope.

jects. Kircher, also, in his *Ars Magna Lucis et Umbræ*, describes, as an invention of his own, the former of these constructions, and distinctly traces the relation between the angle of inclination of the mirrors and the number of images formed. The very same contrivance was afterwards adopted by Bradley, for the purpose of assisting in the designing of garden plots and fortifications; and he states that, " from the most trifling designs, we may, by this means, produce some thousands of good draughts." But the particular application of this principle in the case where the two reflectors are inclined to one another at a small angle, so as to form a series of symmetric images, distinctly visible only in a particular position of the eye, was a discovery reserved for Sir David Brewster. The first idea of this remarkable property occurred to him in the course of some experiments in which he was engaged on the polarization of light, during the year 1814. But the only circumstance which at that time attracted his attention, was the circular arrangement of the images of a candle round a centre, and the multiplication of the sectors formed by the extremities of the plates of glass, between which the light had undergone several successive reflections. In repeating, at a subsequent period, some experiments of M. Biot on the action of homogeneous fluids upon polarised light, and in extending them to other fluids which he had not tried, Sir David Brewster happened, for greater convenience, to place them in a triangular trough, formed by two plates of glass, cemented together by two of their sides, so as to form an acute angle. The ends being closed up with pieces of plate-glass cemented to the other plates, the trough was placed horizontally, for the reception of the fluids. The eye being necessarily placed without the trough, and at one end, some of the cement which had been pressed through between the plates at the object end of the trough appeared to be arranged in a remarkably regular and symmetrical manner. Pursuing the hint thus obtained, and investigating the subject optically, he discovered the leading principles of the kaleidoscope, in as far as the inclination of the reflectors, the position of the object and that of the eye, were concerned. He then constructed an instrument in its simplest form, and showed it to some of the members of the Royal Society of Edinburgh, who were much struck with the beauty of its effects. Several very material improvements were subsequently made by the inventor, in the construction and application of the instrument, for which he then took out a patent. But, in consequence of one of these instruments having found its way to London, its properties became generally known before any number of the patent kaleidoscopes could be prepared for sale. It very quickly became popular, and the sensation it excited in London throughout all ranks of people was astonishing. Kaleidoscopes were manufactured in immense numbers, and were sold as rapidly as they could be made. The instrument was in every body's hands, and people were everywhere seen, even at the corners of streets, looking through the kaleidoscope. It afforded delight to the poor as well as the rich; to the old as well as the young. Large cargoes of them were sent abroad, particularly to the East Indies. They very soon became known throughout Europe, and have been met with by travellers even in the most obscure and retired villages in Switzerland. Sir David Brewster states, that no fewer than two hundred thousand kaleidoscopes were sold in London and Paris in the space of three months; " and yet," says he, " out of this immense number, there is, perhaps, not one thousand constructed upon scientific principles, or capable of giving any thing like a correct idea of the power of the kaleidoscope; and of the millions who have witnessed its effects, there is perhaps not one hundred who have any idea of the principles upon which it is constructed, and of the mode in which those effects are produced." To convey a knowledge of these principles is the object of the present article.

Optical principles on which it acts.

It follows from the optical law of the equality of the angles which the incident and reflected rays make with a line perpendicular to the reflecting surface at the point of incidence, that rays which diverge from any object, and fall on a plane surface, will, after reflection, proceed in the same course as if they had immediately diverged from a point situated at the same distance behind the reflecting surface as the radiant point is before it. This point is called the *virtual focus* of those rays; and the eye receiving them will have the perception of a reversed image of the object in this situation. Thus the miror AA′ (Plate CCCXIX. fig. 1) will produce a reversed image of the object R, situated at the point S, in the line RpS, perpendicular to the surface of the mirror; and this image will appear in the same place whatever be the situation of the eye, as E, provided the reflected rays rE meet it.

Since the course of the reflected rays is the same as if they had immediately proceeded from a real object of S, where its image is seen, this image will, with relation to another mirror, have all the effect of a real object; and a second reflection of the rays by a new mirror at BB′, will produce, at the point T, equally distant from BB′ as S is, but on the other side of it, an image of the first image, visible to the eye at E by the twice reflected rays RqvE. As the first image was reversed with respect to the object, so the second image will be reversed with respect to the first, and therefore direct when compared with the object. The second image may, it is evident, by a new reflection from the first mirror, give rise to a third, which will now again, like the first image, be reversed; and so on, in succession, may a series of images alternately reversed and direct be produced on each side, by two mirrors only, in consequence of multiplied reflections, provided the mirrors are of sufficient extent to admit of them, and provided the eye be so placed as to receive the rays which are last reflected.

If the mirrors be parallel to each other (see fig. 2), the images of the intervening objects, AA′BB′, will be ranged in succession in a continued line on each side. If they be somewhat inclined to each other (as in fig. 3), the images will be disposed in the arch of a circle, having for its centre the point in which the directions of the mirror unite. If the mirrors be of sufficient length, or sufficiently inclined, so as actually to meet; and if, moreover, the angle they form be an even aliquot part of a circle, the images of all the objects situated in the space between them, ABC, fig. 4, will together occupy a circular field, and will be disposed in the form of sectors all round the circle.

General method of tracing the course of the rays.

This circular arrangement of the images, however legitimately it may have been deduced from the simplest law of optics, appears to be so extraordinary an illusion of the sense, as to call for somewhat further examination before we can feel perfectly assured that it is a necessary consequence of that law. Perhaps the most satisfactory method of prosecuting their examination is to investigate separately the mode in which each of the images results from the successive reflections by the two mirrors. A very simple and convenient rule may be laid down for enabling us to trace the whole course, however complex, of the rays which form these images; and this rule will be best understood by considering, as an example, its application to one of the remote images in the circular field. Thus, in the circular field AHL, fig. 5, divided into equal sectors by the radii CF, CG, CH, &c. let S be one of the remoter images of the object R, formed by four reflections from the mirrors AC, BC; and let E be the place of the eye. Draw the line ES, intersecting the radii already mentioned, in P, Q, T, V; make Cq equal to CQ, and join Pq; make Ct equal to CT, and join qt; make Cv equal to CV, and join tv and vR. Then Rvtq PE will be the real course of the rays, by which the image of R is seen at S by the eye at E; for it is sufficiently apparent, without the necessity of a formal demonstration, that by this construction, the equality of the angles of incidence and reflection is everywhere preserved. The different positions of the line PS, that is, PQ, QT, TV, and VS, are in fact the images of Pq, gt, tv, and vR respectively, which are so many portions of the real course of the reflected rays. It is evident that a similar construction will, in every other case, furnish us with the actual course of all the rays from which images result, through all their successive stages of reflection; and it has also the advantage of giving us the exact angles of incidence and reflection throughout the whole path.

We have hitherto, for the sake of perspicuity, supposed both the object and the eye, together with the path of the rays, to be in the same plane. But it is obvious that the same method of construction and of reasoning may be employed in tracing their course, if we suppose the mirrors to be prolonged in a direction perpendicular to the plane of the figure, and the eye raised above that plane. The space between the mirrors, instead of being the sector of a circle merely, is now the sector of a cylinder; which cylinder may be completed by supplying the other sectors which compose it, as is represented in fig. 8, where ACac and BCbc being the mirrors, the rest of the cylindrical space is occupied by complementary sectors. The course of the rays by which the eye at E will see the image S, for instance, of the object R, may readily be traced by drawing a straight line from E to S, which will pass through as many planes BCbc, &c. as the rays have suffered reflections. The portions of the lines ES, intercepted between these planes, may, as in the former case, be regarded as the images (either reversed or direct, as the case may be) of some portion of the actual path of the rays between the mirrors; A will occupy the same position with regard to the complementary sector it traverses, as the real path does in the original sector bounded by the mirrors. By drawing, in this sector, lines similarly situated with respect to its sides, as the several portions, PQ, QT, TS of the lines ES, are with respect to the sides of their respective sectors, we obtain the real course of the rays, RtqpE.

Creation of symmetrical appearances.

Symmetry appears to be the principal constituent of beauty in the forms given to the various works of art which have exercised the skill and ingenuity of man; and the richness of each individual ornament, as well as the pleasing effect of the whole assemblage, is generally in proportion as this principle has received a more perfect development. Even nature, in the multitude of forms with which she has invested the different tribes of the animal creation, has, with but few exceptions, followed the law of symmetry, in as far as respects the perfect similarity of the two sides of the body. In almost all the higher classes, or those which are comprehended under the great division of vertebrated animals, and in many of the inferior tribes, as in insects, one half of the animal form is the reflected image of the other half. A still higher degree of beauty, derived from a more extended symmetry of form, has been displayed in the structure of objects in the vegetable kingdom. Flowers, in particular, derive a peculiar beauty from their presenting to the eye a symmetrical combination of forms with reference to a common centre. This is also the general model followed in the structure of radiated animals, of which the star-fish and sea anemone are examples. In those works of art in which there is the greatest scope for the indulgence of fancy in the production of pleasing effects, the most perfect and successful kinds of ornament are those resulting from a symmetrical arrangement of parts, which is not confined to a single lateral repetition, but is extended in various directions in space, and is multiplied and alternated in different lines, and around different centres. It is the latter of these combinations, more especially, that is represented by the kaleidoscope, namely, the disposition of a certain number of pairs of images symmetrically disposed around one or more centres.

On examining the subject more minutely, we find that the first element of this symmetry consists in the union of any particular form, or of its direct image with its reversed image, by which a new form is created, composed of two simple forms similar to each other, and similarly situated with respect to a given line. If a succession of these compound forms be now arranged around a centre, they will combine into a perfect whole, in which all the similar parts are brought into union, and which must thus afford pleasure, by enabling the mind readily to take in and comprehend every part at a single glance. The operation of the kaleidoscope is, in this way, to create regularity and symmetry out of every form that is presented to it, however irregular in itself that form may be. Thus, out of the few simple lines contained in fig. 9, the appearance presented in fig. 6 is created by the instrument. It is scarcely necessary to observe, that the original lines, which occupy the sector between the mirrors, are seen by direct vision, and that their appearance unites itself on each side with their images seen by reflection. We shall in future designate the whole of the appearance thus produced by the kaleidoscope by the term *spectrum*.

Appearances of polygons, stars, curves.

If we examine the effect produced by each elementary portion of the compound figure of the spectrum, we shall find that any straight line reaching directly across the sector, as *fg* (fig. 9), is formed by the kaleidoscope into a regular polygon, having as many sides as the numbers into which the circular field is divided; if it be at right angles to either of the sides, the polygon will have only half the number of sides. A line, as *mn*, crossing the field between the mirrors in an oblique direction, is converted by the instrument into a polygon of the same number of sides as the former, but with salient and re-entering angles; that is, into the form of a star, with a number of rays equal to half the number of sectors. Another line crossing the field in an opposite direction gives another star, having its rays intermediate to those of the former. Curved lines form by their union a multitude of beautiful and elegant figures, of which the variety is inexhaustible. Each group, taken separately, possesses its peculiar and intrinsic beauty; but the effect of the whole assemblage is considerably heightened by the combination, and by the regularity of the relations that each part bears to all the others.

Requisite conditions.

Having thus given an account of the general principles upon which the kaleidoscope is constructed, and of the mode in which it acts, we are now prepared to direct our attention to the conditions which are required for the perfect performance of its functions.

Economy of light.

If the mirrors of the kaleidoscope could reflect the whole of the light which falls upon them, the images would possess the same degree of brilliancy as the objects from which they are derived; and their number would be limited only by the more or less favourable position of the mirrors, and of the eye with relation to the objects. But as a very large portion of the incident light is, in most cases, destroyed by reflection, it follows that each successive image will be fainter than that which preceded it; and that in the progress of the reflections we must very soon arrive at a limit beyond which they become no longer visible. It is found, from experiment, that the quantity of light lost by reflection is in all cases greatest when the rays fall perpendicularly on the mirror, and least when they fall with the great-

Kaleidoscope.

est obliquity. The difference is more considerable in the case of glass than in that of metallic surfaces. Thus, in a common looking-glass, the images of objects seen by holding it directly opposite to them are produced wholly by the surface of the quicksilver, those reflected by the glass being too faint to occasion any interference. If the glass be placed obliquely, so that the angles of incidence and reflection be large, a greater proportion of light will be reflected from the glass, and the images formed by it will be bright enough to be seen, and will mix themselves with the images from the quicksilver. At a certain angle, both sets of images will appear of equal brightness; and by still further increasing the obliquity, those produced by the quicksilver will gradually fade away, and vanish, leaving the images produced by the glass perfectly distinct, and nearly as brilliant as the objects themselves.

The following table, abridged from one given by Sir David Brewster, and founded on the experiments of Bouguer, shows the number of rays reflected from plate-glass at various angles of incidence, the number of incident rays being supposed to be 1000.

Complement of the Angles of Incidence.	Rays reflected out of 1000.	Complement of the Angles of Incidence.	Rays reflected out of 1000.
$2\frac{1}{2}°$	584	30°	112
5	543	35	79
$7\frac{1}{2}$	474	40	57
10	412	50	34
$12\frac{1}{2}$	356	60	27
15	299	70	25
20	222	80	25
25	157	90	25

With the help of this table, and the method above explained of tracing the course of the rays, and on investigating the angles of incidence, the degree of illumination of any part of the spectrum might be calculated, were it not for a new condition, termed *polarisation*, with which the rays of light are affected by reflection, and which may also contribute to the further loss of light, when the reflection is repeated at certain angles, and in certain positions of the plane in which it takes place; a circumstance which is not without its influence in the case of the kaleidoscope, especially in those constructed with glass mirrors.

As the effect which the kaleidoscope is intended to produce is to be the result of repeated reflections, it is an object of essential importance, in order that as little light may be lost as possible, that all these reflections should take place with the greatest obliquity. With this view, the mirrors should be of considerable length, and the eye should be raised above the field of view, and brought as near as possible to the planes of the mirrors; that is, as near as possible to the remote end of the line of their intersection. From this situation the remoter sectors will be seen by a greater quantity of light than from any other, and consequently the illumination of the spectrum will be more equal in every part. This position of the eye affords the further advantage of giving to the spectrum a circular appearance; for it is obvious, that if viewed from any other and more oblique situation, it would, from the laws of perspective, appear more or less elliptical. It is scarcely necessary to remark, that the eye cannot be mathematically in the line of junction of the mirrors, for no light would in that case reach it by reflection from them.

Proportions of the mirrors.

The essential parts of the kaleidoscope, then, are the two mirrors ACE and BCE (fig. 10), which should be from six to ten inches in length, and from one inch to an inch and a half in breadth at the object end C, while they are made narrower at the other end E. They are kept apart at their upper edges, and united along their lower edges CE, so as to form an angle which must be an even aliquot part of a circle. The angles 36°, 30°, $25\frac{5}{7}$°, $22\frac{1}{2}$°, 20°, or 18°, which divide the circumference of the circle respectively into 10, 12, 14, 16, 18, and 20 equal parts, are the only angles which can conveniently be employed with glass mirrors. The objects to be viewed must occupy the space ABC, between the ends of the mirrors, and must be situated in the plane formed by these lines. They are to be viewed from the opposite or narrow end *e*; the eye being placed near to the angular point E, formed by the junction of the ends of the mirrors. It should, however, be a little above this point, in order that a sufficient quantity of light may enter through the pupil. By trial, the proper distance at which the maximum of illumination is obtained will easily be found.

Accuracy in their junction.

It is of considerable importance that the junction of the mirrors be a perfectly straight line, free from roughness, and from particles of dust. Any irregularity in this line will interfere with the perfection of the image at that part most remote from the object. The projection of this line of junction of the mirrors on the field of view is a line CD, fig. 4, immediately opposite to the middle of the space between the mirrors. If tolerable pains have been taken to apply a straight and smooth edge of one mirror upon the surface of the other, and to preserve them clean, this line will scarcely be seen, more especially as the greater part of it is placed much nearer than the objects contemplated, and lies, therefore, within the distance to which the refractive powers of the eye are adapted; it is, therefore, seen only indistinctly.

Angle of their inclination.

Any deviation in the angle formed by the mirrors from that which accurately divides the circle into an even number of sectors, is quickly perceived by the eye, from the consequent irregularity which takes place in the compound figure of the spectrum at the part most remote from the object. This is illustrated by fig. 7, where the last ray of the star is seen to be imperfect, from the want of correspondence in the images which meet in the remote sector. If the angle be too small, the image is redundant, from a reduplication of one portion; if too large, the image presents a deficiency. But, in consequence of the aperture of the pupil being of sufficient size to admit portions of the images from both mirrors, reflected from the parts immediately adjacent to the line of their junction, these two images will be, for a certain space, seen in the same direction, and will consequently overlap and interfere with each other. As soon as the angle of the mirrors is rendered correct, the double images coalesce into one, and perfect symmetry is restored to the spectrum. It is necessary to observe, that the angle must be an *even* aliquot part of a circle; that is, must divide it into an even number of equal parts. If the division were into an odd number of parts, as in fig. 7, the discordance of the adjacent images at the remote sectors would be the greatest possible. This will appear from considering that the images in the successive sectors on each side, being alternately reversed and direct, those in the sectors immediately adjacent to the radius most remote from the mirrors, would both be of the same kind; the one, therefore, could not be the reverse of the other, a relation which, as we have already seen, is the elementary condition of symmetry in each pair of images. The corresponding parts of each, indeed, instead of being adjacent, would then be the most remote from one another. This circumstance, namely, the necessity of the angle of the mirrors being the even aliquot part of a circle, although it be an essential condition of the instrument, is not mentioned in the specification of Sir David Brewster's patent. It was first noticed by the author of this article in the *Annals of Philosophy*.

If we investigate the proportion of light distributed over

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Dimensions of the mirrors.

the field of view, by considering the degrees of obliquity with which the rays impinge upon the mirrors, and also the number of reflections which they sustain, we shall find that it diminishes nearly in the same proportion as we recede from the edge of the sector bounded by the mirrors, and is least in the remotest sector. The line of equal illumination in each individual sector, or the *isophotal* line, as Sir David Brewster has termed it, is parallel to that radius of the sector which is nearest to the mirror on that side. It follows as a consequence, that the light will diminish in each sector in proportion as we recede from the angular point or common centre of the field. This last circumstance limits us to the magnitude which it would be proper to allow to the field of view, and therefore restricts us in the breadth of the mirrors when they are of a given length. In general, their breadth should not exceed one sixth of their length, and the angle subtended by the circular field will then be about 19°. The proper proportion, however, varies according to the angle at which the mirrors are inclined. The larger this angle, the greater latitude may be allowed in extending the field of view; while, if the angle be small, the number of reflections for completing the remote parts of the spectrum will be great; the light will become too faint to allow the eye to distinguish the parts at the circumference; and the diameter of the field must be contracted by lessening the breadth of the mirrors.

What has now been said relates only to the proportional length and breadth of the mirrors. With regard to their absolute size, we must be guided in our choice by other circumstances of convenience. As the length of the instrument determines the distance of the eye from the field, it should be such as to admit of the distinct vision of every part of the spectrum. This may be effected, if requisite, by interposing a convex lens, of the proper focal distance, between the eye and the narrow end of the mirrors.

Position of the objects.

The last circumstance we shall notice as essential to the perfect operation of the instrument, is, that the objects must be situated as nearly as possible in the plane ABC, fig. 10, formed by the ends of the mirrors. All deviations from this position are productive of irregularity in the spectrum. If the eye, indeed, were a mere mathematical point, and were it possible for it to receive the rays while placed at the very point of the angle E, the distance of the object from the mirrors would, in strictness, produce no deviation from symmetry. Let the plane MN be taken at a little distance from the ends of the mirrors, and the planes of the mirrors produced till they meet it in the lines *ac* and *bc*. It is evident that the space comprehended between these lines, is the only situation in that plane from whence rays can proceed so as to fall upon the mirrors; no object, therefore, which is not within that space, can have its image formed by reflection from the mirrors. The lines *ac* and *bc* are the projections of AC and BC as viewed from the point E. But if the eye be raised to *e*, it will be apparent that a space below the former, and bounded by the lines *de* and *fe*, which will now be the projections of AC and BC, will come into view. The objects situated in this space will have no corresponding images, and their introduction into the field of view will produce confusion in every part of the spectrum. The magnitude of this additional space, measured by the interval *cr*, which is unrepresented by the instrument, and which may be termed the *aberration*, is dependent upon and proportional to two separate causes, namely, the distance of the eye from the angular point, and the distance of the object from the mirrors. The deviation from regularity which it produces in the spectrum increases as the object approaches to the centre. An eye accustomed to observe and admire the symmetry of the combined images will instantly perceive it to be violated, even when the distance of the object Cc is less than the twentieth part of an inch. When the object is very distant, the defect of symmetry is so enormous, that, although the object is seen by direct vision, and also in some of the sectors, it is entirely invisible in the rest. If the object, on the other hand, be placed within the reflectors, a symmetrical spectrum will indeed be formed; but the centre of this spectrum will not coincide with the centre of the circular field of view, and its effect in producing a symmetrical picture is thereby entirely destroyed. In order to insure perfect mathematical symmetry, the objects should, strictly speaking, be limited to lines lying in the same plane, which plane must be exactly in contact with the ends of the mirrors.

Polycentral kaleidoscopes.

We have hitherto considered the effects resulting from the combination of only two mirrors, in which case the field of view is necessarily limited to a circle. But on the very same principles we may, by employing a greater number of mirrors, obtain an extension of this field in all directions, and produce groups of images around several centres, which shall be repeated in perpetual succession on every side. Kaleidoscopes of this description have on that account been called *Polycentral*, and, when properly constructed, their effects are exceedingly beautiful. With respect, also, to their utility, as applicable to the arts, they very far excel the simple kaleidoscope, inasmuch as the occasions requiring an ornamental design for a flat extended surface are of much more ordinary occurrence than those in which we are limited to a circular space. The principles upon which polycentral kaleidoscopes should be constructed, and the conditions to which they are limited, were first pointed out by the author of this article, in the *Annals of Philosophy* (vol. xi. p. 375), soon after the common instrument became known in London.

Only fo[ur] species [ad]mitted [of].

It is evident that, by joining together a number of mirrors, so as to compose the sides of a prism, we might obtain a succession of images in every possible direction. But we must recollect that, for the production of symmetrical combinations of images, we are restricted in our choice of a base for the required prism, to such angles only as will divide the circle into an *even* number of aliquot parts. This condition confines us to a very limited range. It excludes, in the first place, all angles above 90°; and, therefore, all polygons having more than four sides. Of four-sided polygons, the square and the rectangle, where all the angles are right angles, are the only figures that can give symmetrical combinations. After these, there remain only triangles; and, among all the possible varieties of triangles, we can take only such as are formed with angles of 90°, 60°, 45°, or 30°, which are the quotients of 360°, divided by 4, 6, 8, and 12; all the other even aliquot parts of the circle being excluded by the necessary condition that the sum of those angles must be equal to 180°. We are, therefore, limited to the three following species of triangles, represented in figures 15, 16, and 17:

The first having all its angles equal to..60°, 60°, and 60°;
The second its angles respectively equal to....................................90°, 45°, and 45°;
And the third its angles respectively equal to.................................90°, 60°, and 30°;
The sum of these angles, in each case, being 180°.

Let us now inquire into the effects resulting from each of these combinations.

Comparative effects of the

The comparative effects of these four species of polycentral kaleidoscopes are illustrated by figures 14, 15, 16, and 17, where A, in each case, represents the sections of the mirrors, or the base of each prism; B, the elements of each pattern; and C, the pattern itself, resulting from the series of reflected images.

It will be seen that the square polycentral kaleidoscope, fig. 14, produces a less pleasing effect than the others, because the attention being more particularly directed to the repetition of the same set of images in one direction only, the whole pattern appears composed of an alternation of longitudinal stripes. The direction of the stripes is determined by the general direction of the lines, in the elementary pattern approaching more to one of the sides of the base than to the other side. It is scarcely necessary to observe, that the spectrum produced by a rectangular is quite similar to that of a square kaleidoscope, only that it is more extended in one direction.

The first of the triangular polycentral kaleidoscopes (fig. 15), which has for the base of its prism an equilateral triangle, affords very regular combinations of images, disposed in three different directions, which cross each other at angles of 60° and 120°; thus presenting what may be called a triangular symmetry. The circumstance of each pair of images being combined in groups of three together in every part of the spectrum, has suggested the name of *Triascope* for this species of triangular polycentral kaleidoscope.

The second species of triangle (fig. 16), which may be made the base of the prism, is that composed of two contiguous sides, together with the connecting diagonal of a square; or, in other words, of a right-angled isosceles triangle. The result of this construction is to produce a division of the field of view into regular square compartments, having the base of the above-mentioned triangle for their sides. The very perfect symmetry which results from this construction is the source of remarkably beautiful designs; the predominant character of which is an arrangement of forms grouped together by fours at a time, and symmetrically disposed in squares. Such an instrument may, on this account, be called a *Tetrascope.*

The last species of triangular polycentric kaleidoscope, or that which takes for its base the half of an equilateral triangle (fig. 17), resulting from its division by a perpendicular drawn from an angle to the opposite side, affords also appearances of very considerable beauty. Here the predominant form is the hexagon, from the circumstance that the smallest of the angles, which is that of 30°, producing the greatest number of repetitions of the same image around one centre, the symmetry is most conspicuous with reference to that centre, and the attention of the spectator is immediately directed to the hexagonal compartments into which the field is thereby divided. As the pairs of images in these leading objects (such as the stars in the figure, which, it will be observed, have each six rays) are six in number, we shall, following the analogy of the other names, denominate this variety of the instrument a *Hexascope.* These names, derived from the circumstance which gives the chief character of symmetry to the extended spectrum, will perhaps be considered as sufficiently appropriate. They will, at all events, recommend themselves by their brevity, when we consider the very compound epithets which would otherwise be required in order to designate correctly the equiangular, triangular, polycentral kaleidoscope; the rectangular, isosceles, triangular, polycentral kaleidoscope; and the semi, equilateral, triangular, polycentral kaleidoscope.

As a plane surface of indefinite extent admits of subdivision, by regular polygons of the same kind, only in three ways, namely, by triangles, by squares, and by hexagons, so each of these modes of division is the result of a separate arrangement of three plane mirrors, namely, that of the triascope, the tetrascope, and the hexascope. Of these, the last two appear to be those more especially calculated to afford assistance to artists in the invention of ornamental patterns.

It is evident, that the principal advantage which the polycentral kaleidoscopes have over the simple ones, is the greater extension they give to the field of view. This field might, in theory, appear to be infinite; but in practice it soon becomes limited, from the great loss of light attendant on repeated reflections. The effects of polarization, in further diminishing the light, is also greater in them than in the simple kaleidoscope. On both these accounts, metallic are preferable to glass mirrors for their construction. The number of reflections required, in order to obtain any extent of spectrum, being greater than in the ordinary kinds of simple kaleidoscopes, the instrument must be of greater length comparatively with the breadth of the mirrors, as in this way the course of the rays will be more oblique with respect to the mirrors, and a larger portion of light will reach the eye. A greater obliquity is also obtained, with the same proportion between the length and breadth of the mirrors, by making them taper at the end next the eye. The instrument will then, see fig. 18, have the form of a truncated pyramid instead of a prism; ABC being the triangular base, to which the objects are to be applied, and *abc* the narrower end at which the eye is applied. It is true, that, in mathematical strictness, this construction is incorrect; for the mirrors in that case having necessarily a degree of inclination to the base, the spectrum will be composed of portions, not of a plane, but of a spherical surface, which does not admit of the same divisions; but the field really visible to the eye is too limited to render this inaccuracy of any consequence.

Construction of the simple kaleidoscope.

After the detailed explanation which has been given of the principles on which kaleidoscopes act, it will not be necessary to enter into any minute account of the methods of constructing them. A few practical directions may, however, be useful for the guidance of such as wish to provide themselves with this source of innocent amusement. In order to construct the simple kaleidoscope, two slips of plate-glass, about six or eight inches long, and about an inch or an inch and a half in breadth, must be procured. The best form for these plates is that represented in fig. 10, where one end of them is only half the breadth of the other. The newest plate-glass should be employed, as that which is old has frequently scratches and imperfections on its surface, which occasion a great loss of light. They should have been skilfully cut with a diamond, so that at least one of the edges may be perfectly smooth, and free from chips. If this be not the case, one of the edges must be made quite straight, and freed from all imperfections, by grinding it with very fine emery upon a flat surface, such as another piece of plate-glass. The posterior surfaces of each of the plates are now to be covered with a black varnish, or with black sealing-wax, so as to remove its reflective power. When this has been done, and the varnish is dry, take the plate of which the edge has been rendered perfect, and apply this edge against the surface of the other plate, as near as convenient to the edge of this latter plate, and keep the edges so applied in contact, by means of a strip of black silk or cloth glued along the back of the plates, so as to serve the purpose of a hinge, allowing of their opening and closing to a certain extent, like the leaves of a book. They are now to be adjusted to the proper angle, which may be done with the greatest accuracy, by directing the mirrors, placed as in fig. 10, to any line, or the straight edge of any object in contact with the broad ends, and very obliquely situated with respect to the edge of either of the mirrors; then, looking from the other end, open or shut the plates till the figure of a star appears, having six, se-

Kaleidoscope.

ven, eight, or any other number of rays which may be thought desirable, and observing that the images of the rays in the spectrum most remote from the object perfectly coalesce. The mirrors must now be fixed in their position by small arches of wood or brass, extending across the open ends of the plates AB in two or three places. These may at first be attached temporarily by means of sealing-wax; but they should afterwards be fastened more securely by other pieces glued to the plates in several places along the edges Ae, Be. The clearness of the effect of the instrument is much promoted by excluding all light, except what comes from the field of view; and this is best accomplished by laying a strip of black velvet, previous to the fixing of the pieces just described, all along the upper side of the instrument, so as to line the whole of the space between the upper edges of the mirrors. All reflection of light from that quarter is thus effectually precluded.

The plates thus prepared are to be placed in a tube, as represented in fig. 11, so that the broad ends of the mirrors shall barely project beyond the end of the tube; while the narrow end is placed so that the angle formed by the junction of the mirrors shall be a little below the middle of that end of the tube. The plates must then be kept in this position by pieces of cork or wood wedged in between them and the tube; taking care, however, that they press but lightly on the mirrors, for a very slight force is capable of bending and altering the figure, even of very thick plates of glass. A cover, with a circular aperture in the centre, is then to be fitted to the end *abc*, which should, in general, be furnished with a convex lens, whose focal length is an inch or two greater than the length of the mirrors, in order to allow the eye to see every part of the spectrum with perfect distinctness. Persons who are short-sighted will of course not require this lens; but it will still be expedient to close the end *abc* of the mirrors with a piece of plane glass, as a security against the introduction of dust.

Of polycentral kaleidoscopes.

In constructing polycentral kaleidoscopes, where three mirrors are employed, the third mirror occupies the place of the black velvet and connecting pieces already described. Great care should be taken to have three very perfect edges for the junctions of the plates with each other; and considerable attention should be paid to their being fixed at the exact angles required by the construction; and when once placed correctly, they are to be retained in their relative position by effectual securities. Similar remarks apply to the construction of square and rectangular polycentral kaleidoscopes.

Revolving object case.

The instrument, when so far completed, is now ready to be applied to the objects which are to form the spectrum. A case for holding these objects, and for communicating to them a revolving motion, is fitted to the object end of the tube. The best construction for such a case is the following: Upon the end of the tube *abcd*, fig. 12 (corresponding to the end of the mirrors ABC, fig. 11), is placed a ring of brass, *mn*, which moves easily upon the tube, and is kept in its place by a shoulder of brass on each side of it. A brass cell, MN, is then made to slip tightly upon the moveable ring *mn*, so that when the cell is turned round by means of the milled end at MN, the ring *mn* may move freely upon the tube. The objects are to be placed in a small box, consisting of two glasses, one transparent, and the other ground, kept at the distance of one eighth or one tenth of an inch by a brass rim. This brass rim should consist of two pieces which should screw into one another, so that the box can be opened by unscrewing it, and the objects changed at pleasure. This object box is placed at the bottom of the cell MN, as shown at OP; and the depth of the cell is such as to allow the side O to touch the end of the mirrors when the cell is slipped upon the ring *mn*. The instrument, when used, is to be held in one hand, with the angular point E downwards, and the cell is turned round with the other, so as to present the objects in succession before the aperture ACB, fig. 11.

Selection of proper objects.

The objects best fitted for producing pleasing effects are small fragments of coloured glass, of sufficient size to occupy a certain portion of the interval between the mirrors, but not so large as to engross the greater part, or to interfere with each other's motions, as they are made to fall in succession into the field of view, by the revolution of the case which holds them. Wires of glass, both spun and twisted, and of different colours and shades of colours, and of various shapes, both curvilineal and angular, may be intermixed with the larger masses of coloured glass, together with one or two beads, bugles, fine needles, bent metallic wires, small pieces of lace, and fragments of fine sea-weed. Looped curves like the figure 8, double curves like the letter S or the figure 3, circles, ovals, spirals, triangles, or lines bent into angles like the letter W or Z, have generally a good effect, either alone or in combination with other objects. Care should, however, be taken not to crowd the case with too many objects at a time, as an excess in this respect produces a degree of complexity totally inconsistent with beauty. In order to obtain a greater variety in the styles of patterns produced, a number of different cases, with objects, may be provided, so as to fit on occasionally, and be changed at pleasure.

Telescopic or compound kaleidoscope.

By Sir David Brewster's very ingenious contrivance of substituting for the case of objects above described, and which is applied in contact with the ends of the mirrors, a convex lens placed at a certain distance from them, the images of distant objects may be brought to occupy the exact place adapted for their reflection by the kaleidoscope, and may thus afford a still greater variety of symmetric combinations. This operation of the lens is illustrated by fig. 13, where the lens L forms an image of the object R at F, the space between the ends of the mirrors, which image is multiplied by the reflecting powers of the instrument, and forms a symmetric spectrum, precisely in the same way as if a real object of that size had occupied its place. The lens may be fitted to the end of a separate tube, external to that of the instrument, and capable of being drawn out upon it to the proper distance, which is known by observing when the spectrum appears perfectly symmetrical. The instrument in this form has been called the *Telescopic* or *Compound Kaleidoscope;* and is applicable to distant objects of every description, and equally so to those in motion as to those at rest. All their movements are represented with singular effect in the spectrum. A blazing fire viewed by it gives the appearance of beautiful fire-works, at one time rushing with great rapidity towards the centre, and at another issuing from it towards the circumference, or darting in splendid starriform corruscations over the field of vision. These varieties in the spectrum are occasioned both by turning the instrument round its axis, and by moving it forwards in any direction.

The compound kaleidoscope has thus a much more extended range than the common kind; and it has this further advantage, that it admits of the symmetry of the spectrum being rendered perfectly correct, since the images may be brought exactly to the ends of the mirrors; a condition which can never be completely obtained when the objects are confined in a glass case, as they must then always be separated from the mirrors by at least the thickness of the glass.

The focal length of the lens should always be much less than the length of the outer tube, and should in general be such as to be capable of forming an image at the lendar || lenda- ium stum. end of the mirrors, when the object is four or five inches from the lens. Its diameter should be such as that, when it is at its greatest distance from the mirrors, it shall still occupy the whole of the field of view which is seen by direct vision; or, in other words, that the eye shall not see any part of its edge.

Appli- on to magic lanthorn, & The exhibition of the effects of the kaleidoscope to a number of spectators at the same time, by throwing the images on a wall, after the manner of the magic lanthorn, or solar microscope, might be easily accomplished, if sufficient light could be procured for the illumination of the objects. The form of an instrument for this purpose is represented in fig. 20, where L is the lamp, the light from which being augmented by the reflector M, and concentrated by the very convex lens N, upon the transparent objects at the end of the kaleidoscope K, is formed into an image on the opposite wall by refraction through the lens P, the focal distance of which is somewhat shorter than the length of the tube. The brilliant light produced during combustion carried on by means of a stream of oxygen gas is peculiarly fitted for the exhibition of these effects, as was very successfully shown by Mr William Allan, in his lectures at Guy's Hospital, London.

By a contrivance on a similar principle, the patterns formed by the kaleidoscope may be copied, if thought necessary, by receiving them in a camera obscura. The readiest mode of tracing them, however, is by the use of a camera lucida, applied to the instrument at the end next the eye. The kaleidoscope might also be applied to the microscope, if it were worth while to multiply these applications; for which, however, considering the infinite variety of designs which the simpler instruments afford, there appears not to be the least necessity.

Solid kaleidoscopes. Instead of employing the exterior surfaces of glass as the reflectors, we may employ the interior surfaces of a prism of solid glass for that same purpose; and we may obtain in this way, as was shown by Sir David Brewster, a total instead of a partial reflection of light. This solid form of the instrument is peculiarly fitted for polycentral kaleidoscopes; but it is liable to the objection of its being extremely difficult to procure a piece of glass of sufficient size entirely free from veins, and also to obtain the perfect junction of the two reflecting planes.

Polyangular, annular, and rectilineal kaleidoscopes. Simple kaleidoscopes have been variously constructed with reference to the angles of inclination of the mirrors. In some instruments, called by Sir David Brewster *Polyangular Kaleidoscopes*, this angle may be varied at pleasure, by allowing the mirrors to move on their connecting edges as on a hinge, so as to open or close at pleasure by means of a screw. Others admit of the mirrors entirely separating, so as gradually to become parallel to each other, and thus give rectilineal or annular patterns, as is seen in figures 2 and 3. But there is no occasion to dwell more particularly on these subjects, as the circumstances of their construction and effects must be sufficiently obvious from what has been already said; and there is probably more ingenuity than utility in devising these variations. We shall therefore conclude, by merely noticing a convenient mode of uniting several of these instruments, which was suggested by the auther of this article, with a view to compare the effects of the simple and polycentric kaleidoscopes, applied to the very same set of objects. Fig. 20 shows a section of that instrument, in which *mn* are the mirrors of a simple kaleidoscope in the middle of the tube *t*, and which might be set to any angle; the mirrors *def* on one side forming a tetrascope, and *pqr* on the other, a hexascope. The whole was enclosed in the tube *t*, at the eye end of which were three separate apertures, in order to allow the observer to look through each in succession. The other end was fitted with a case of moveable objects, as in figure 12; and was also provided with an additional tube for the reception of a lens instead of the case, and capable of being drawn, so as to convert the whole into a telescopic instrument. The effect of the whole combination was very striking.

See Sir David Brewster's *Treatise on the Kaleidoscope*, Edinb. 1819; Harris's *Treatise on Optics;* Wood's *Optics;* Dr Roget *on the Kaleidoscope, in the Annals of Philosophy*, vol. xi. p. 375; and the *Compte rendu des Travaux de l'Académie de Dijon, pour* 1818, p. 108–117.

KALENDAR, a distribution of time, accommodated to the uses of life. See Calendar.

Kalendar, *Kalendarium*, originally denoted, amongst the Romans, a book containing an account of monies at interest, which became due upon the kalends of January, the usual time when the Roman usurers let out their money.

Kalendar Months, the solar months, as they stand in the kalendar, beginning with January.

Astronomical Kalendar, an instrument engraved upon copper-plates, printed on paper, and pasted on board, with a brass slider which carries a hair, and shows by inspection the sun's meridian altitude, right ascension, declination, rising, setting, amplitude, &c. to a greater exactness than our common globes will show.

Kalendar Brothers, a sort of devout fraternities, composed of ecclesiastics as well as laymen, whose chief business it was to procure masses to be said, and alms distributed, for the souls of such members as were deceased. They were also denominated *kalend-brothers*, because they usually met upon the kalends of each month, though in some places only once a quarter.

KALENDARIUM Festum. The Christians retained much of the ceremony and wantonness of the kalends of January, which for many ages was held as a festival, and celebrated by the clergy with great indecency, under the names of *festum kalendarum*, or *hypodiaconorum*, or *stultorum*, that is, "the feast of fools;" sometimes also *libertas decembrica*. The people met masked in the church, and in a ludicrous way proceeded to the election of a mock pope or bishop, who exercised a jurisdiction over them suitable to the festivity of the occasion. Fathers, councils, and popes, long laboured in vain to restrain this license, which prevailed even at the close of the fifteenth century.

Kalends. KALENDS, or Calends, in the Roman chronology, the first day of every month. The word is formed from a Greek word signifying to call or proclaim, because, before the publication of the Roman *fasti*, it was one of the offices of the *pontifices* to watch the appearance of the new moon, and give notice thereof to the *rex sacrificulus;* upon which a sacrifice being offered, the pontiff summoned the people together in the capitol, and there with a loud voice proclaimed the number of kalends, or the day whereon the nones would fall, which he did by repeating this formula as often as there were days of kalends, *Calo Juno Novella.* Hence the name of *calendæ* was given thereto, from *calo, calare.* This is the account given by Varro. Others derive the appellation from the circumstance, that the people being convened on this day, the pontifex called or proclaimed the several feasts or holidays in the month; a custom which continued no longer than the year of Rome 450, when C. Flavius, the curule ædile, ordered the *fasti* or kalendar to be set up in public places, that every body might know the differences of times, and the return of the festivals.

The kalends were reckoned backwards, or in a retrograde order. Thus the first of May being the kalends of May, the last or the 30th of April was the *pridie kalendas*, or second of the kalends of May; the 29th of April, the third of the kalends, or before the kalends; and so backwards to the 13th, where the ides commence; which are likewise numbered inversely to the fifth, where the nones begin; which are numbered after the same manner to the first day of the month, which is the kalends of April. See IDES and NONES.

The rules of computation by kalends are included in the following verses:

> Prima dies mensis cujusque est dicta *kalendæ:*
> Sex Maius nonas, October, Julius, et Mars;
> Quatuor at reliqui: habet idus quilibet octo.
> Inde dies reliquos omnes dic esse *kalendas;*
> Quas retro numerans dices a mense sequente.

To find the day of the kalends answering to any day of the month we are in; see how many days there are yet remaining of the month, and to that number add two. For example, suppose it the 22d day of April; it is then the 10th of the kalends of May. For April contains 30 days; and 22 taken from 30, there remain 8; to which two being added, the sum is 10. The reason of adding two is, because the last day of the month is called *secundo kalendas*, the last but one *tertio kalendas*, and so on.

The Roman writers themselves are at a loss to account for this absurd and whimsical manner of computing the days of the month; yet it is still kept up in the Roman chancery, and by some authors, out of a vain affectation of learning, preferred to the common, more natural, and easy manner.

KALENDS are also used in church history to denote conferences anciently held by the clergy of each deanry, on the first day of every month, concerning their duty and conduct, especially in what related to the imposition of penance.

KALENDS of January, in Roman antiquity, was a solemn festival consecrated to Juno and Janus, in which the Romans offered vows and sacrifices to those deities, and exchanged presents amongst themselves as a token of friendship.

KALHAT, a sea-port of Arabia, in the province of Ammon, situated at the mouth of a river which falls into the Persian Gulf. It is eighty miles south-east of Muscat.

KALISCH, a city of Poland, the capital of the circle of that name. It is situated between the branches of the river Prosna, in a marshy situation. It contains ten churches, one of which, formerly the Jesuits', is now used by Lutherans. There is a college for military students, in an university which belonged to the Jesuits. It contains 7310 inhabitants, of whom 1800 are Jews. There are manufactories of cloth, hats, and linen goods, and a large annual fair. Long. 18. 55. E. Lat. 51. 51. N.

KALKAS, a race of Mongols, who inhabit an extensive tract of country to the north of China, bordering on Siberia. Their princes and pontiffs dwelt a few years ago in a camp, which is now converted into a city. Only the temples and abodes of the priests, and that of the Chinese viceroy, are built of wood. The rest of the nation dwell in tents.

KALKOON, or Turkey islands, a cluster of small islands in the Eastern Seas, surrounded by dangerous and extensive shoals. Long. 115. 45. E. Lat. 6. 15. S.

KALMUCKS, a tribe of those wandering Tartars who, in the thirteenth century, under Jenghis Khan, subdued and desolated the whole breadth of Asia. The Kalmucks (See ASIA) are distinguished from the other nations of Asia by their peculiar physiognomy. They are in general of the middle size, powerfully and well made, except in their thighs and legs, which are somewhat bent. A large head, round face, dark olive complexion, high and prominent cheek bones, sparkling black eyes punctured in the head, and widely separated from each other, a flat broad nose scarcely rising above the level of the face, and turned up, with two immense nostrils, thick and fleshy lips, and exceedingly white teeth, a short chin, and a thin scanty beard, with black coarse hair, complete the portrait of a Kalmuck face. In many of the women, however, these harsh features are softened, and they have agreeable countenances, with very delicate complexions, which are set off by fine black hair; so that some of the higher classes would even be considered as beauties by the Europeans. They are, like all barbarians, coarse, filthy, and disgusting in their habits; they are covered with grease and vermin, and slovenly and dirty in the extreme. Nor do their moral qualities make amends for these defects. Morality is indeed amongst all nations upon a level with their intelligence, and amongst barbarians is generally at a low ebb. The Kalmucks are accordingly represented as being addicted to lying and cheating, though travellers report that robberies are rare amongst them, and that a murder is almost unknown. They pay great respect to old age; and, though hot in their temperament, and fierce when irritated, they in general live amicably together. Whoever receives a present of meat or drink divides it faithfully amongst his companions; and if a relative has lost his flocks or other substance by war or accident, he is sure to be liberally rewarded. According to Pallas, a Kalmuck provided with a horse, with arms, and equipage, may ramble from one place to another for three months together, without taking with him money or provisions. His friends and relatives, however distant, receive him with all that hospitality which distinguishes barbarous nations; and wherever he goes he meets with the kindest reception, and is entertained in the best manner that their circumstances afford. And a stranger, from whatever country he comes, is sure to be well received by the Kalmucks. His property is faithfully kept for him the moment he puts himself under the protection of his host, it being considered as a crime of the deepest dye to rob any one who is a guest. These tribes, from the prince to the peasant, dwell in tents, which are their only habitations, and are all of a circular form, with a conical roof, and a hole at the top. They are covered with felt made of camels' hair or wool, and are constructed of cane or wood. One of their encampments presents the appearance of a city, with regular streets, sometimes extending a mile in length, and containing numerous shops, where several of the more refined arts are carried on. Here are artificers in copper, brass, and iron; also goldsmiths, who make trinkets for their women, idols of gold and silver, and vessels for their altars; also others who are expert at inlaid work and enamelling. Dr Clarke asserts that these oriental tribes of Kalmucks have, from time immemorial, possessed the art of making gunpowder. The riches of the Kalmucks consist entirely in their flocks. Their habits are wholly pastoral; and they never think of cultivating the ground, though they inhabit extensive tracts of luxuriant meadows, which are of peculiar fertility. Like all pastoral tribes, they emigrate with the seasons, residing with their flocks in the mountains during the summer, and descending in the winter to the verdant plains. They have few camels, these being delicate and difficult to rear; and they are chiefly possessed by priests and by the richer classes. Their horses are small but very swift, and are capable of enduring great fatigue, galloping for several hours successively without injury, or passing a whole day without drinking. Their horned cattle are of a beautiful shape; and their sheep are the same as those which are found throughout Great Tartary. They are exceedingly fat, with large tails and broad and pendent ears; but their wool is so coarse that it can only be used in the manufacture of felt. They live on the milk and flesh of their cattle, and have no objection to horse flesh. They make a fermented liquor from mare's milk, from which they distil a spirit called *koumiss*, of which they are very fond. They are also extremely partial to tobacco and tea. Their principal amusements are hunting, wrestling, archery, and horse-racing. They are expert horsemen, being trained to it from their infancy; and the women are equally skilful with the men. They are, like all barbarous tribes, passionately addicted to gaming; and often lose at cards all that they possess, even to their very clothes. They have also chess, draughts, and backgammon; and the youth of both sexes amuse themselves with singing and dancing to the two-stringed lute. Their most common diseases are malignant fevers, which are greatly aggravated by their gross diet and want of cleanliness. The itch, and other cutaneous diseases, are also common amongst them. Their religion is pagan, and their priests, as amongst every ignorant and superstitious people, are treated with the most extraordinary respect. Their commerce consists entirely in the exchange of their horses and cattle for corn, woollen cloths, linens, copper, pewter, kitchen utensils, knives, and spoons; and great numbers of them visit Astrakan for this purpose. They never deal in slaves; but such prisoners as they take in war are naturalized, and adopted into the tribe.

This powerful tribe, like all the other pastoral states of Asia, has been greatly reduced, both in numbers and extent of territory, by the increasing power of the civilized nations by whom they are surrounded. Before their subjugation or dispersion, they were divided into three principal branches; the Soonganes, the Coschotes, and the Torgots. Of these, the first were engaged in almost perpetual hostilities with the Mongols and Chinese. The Coschotes, on the conquest of Thibet, became subject to the Chinese; and still continue under the protection of that power, except a smaller part which had retired to the Irtish, and fell under the dominion of the Soonganes. The Torgots, who had separated themselves from the Soonganes, settled at an early period amongst the steppes on the Volga; but many of them, disgusted with the tyranny of Russia, returned in great numbers in 1770 and 1771, over the river Ural, on the ice, and across the Kirgusian steppes into Soongaria. It was in 1720 that the Kalmucks were driven from Thibet; and about forty years afterwards, by the extension of Kiang Long's conquests, such as refused to submit to his authority were compelled to seek for new settlements towards the west. Many of them accordingly dispersed themselves in the interior parts of Asia, and amongst the cities of the Usbeck Tartars; others took refuge in Russia, and some thousands fled to Siberia, but the greater number submitted to the Chinese sovereignty. At present the most numerous and powerful tribes of the Kalmucks inhabit the country lying between the Caspian Sea, Muscovy, Samarcand, and Cashgar. Others occupy with their flocks and herds both banks of the Volga, between the Irghis and the Caspian, and extend their excursions on both sides of the Don and the Ural. (F.)

KALUBBLUB, a small island in the Eastern Seas, near the south-western coast of Mindanao. Long. 121. 32. E. Lat. 6. 46. N.

KALUGA, a government or province of Russia in Europe, extending over 13,142 square miles. It contains twelve cities, twelve market-towns, and 2061 villages and hamlets, of which 351, with the people in them, belong to the crown. The whole number of inhabitants are 1,159,600. It is divided into eleven circles. It is generally a level country, the most fertile and the best cultivated of any in the Russian empire, and is the chief source of the supply of provisions to the ancient capital, Moscow. It is estimated to produce 1,600,000 quarters of corn yearly, besides other vegetables for food, and a large quantity of hemp, flax, and fat cattle. The woods are extensive, and yield more fuel than the internal consumption requires. The chief employment, besides agriculture, consists in spinning flax and hemp. It is well watered by the navigable rivers Oka and Shisdra, and by many smaller streams that empty their waters into them. The climate is deemed the most healthy in Russia, and it is certainly the mildest. The city of Kaluga is the capital of the province, as well as of a circle of the same name, which comprehends in it 795 square miles, one city, and 160 villages, with 72,198 inhabitants. It stands on the river Oka, where the Kainschka falls into it. The walls have been recently converted into promenades. It is the see of a bishop, who has a handsome palace. It contains twenty-four churches, 3827 houses mostly of wood, and 24,500 inhabitants, whose chief employment is making sail-cloth and other linen goods, and who, besides, carry on cotton, paper, and china manufactures, and distilleries, sugar refineries, and breweries, all of which render it a flourishing place. Long. 26. 4. E. Lat. 54. 30. N.

KALW, a city of the kingdom of Wirtemberg, in the circle of the Black Forest, and capital of a bailiwick of the same name, which extends over 168 square miles, and contains a population of 20,500 persons. The city is situated on the river Nagold, which divides it into the upper and lower town. It contains 540 houses, with 4250 inhabitants, who are employed in woollen, cotton, and leather manufactures, and carry on much trade in rafting timber by the river.

KAMAKURA, an island in the Eastern Seas, near the south coast of Niphon, in Japan, about three miles in circumference, and surrounded with very high and steep rocks. It is used as a state prison.

KAMENEZ, a city of the province of Podolia, in Russia, the capital of the circle of that name, and the see of the Greek archbishop of Podolia and Brazlow, as well as that of the Catholic bishop of Podolsk. It is, like all the Polish towns, ill built, chiefly of wood, with narrow, crooked streets. It has numerous churches, with several convents, 943 houses, and 5658 inhabitants. Long. 26. 59. 10. E. Lat. 48. 40. 50. N.

KAMINIEC, an ancient town, the capital of the province of Podolia, when it formed part of the kingdom of Poland, but occupied by Russia when that unfortunate country was dismembered the second time. It stands a little to the north of the river Dniester, and was once the strongest fortified place on that frontier. There is some trade, chiefly with Moldavia. It has a Popish and an Arminian bishop. The population is 5600 persons, many of whom are Jews. Long. 27. 1. 30. E. Lat. 48. 50. N.

KAMTSCHATKA, a large peninsula of Asia, which runs out from the north-east coast in a southern direction about 600 or 700 miles, from lat. 59. to 51. N., whilst its greatest breadth is not above half as much. It forms part of the Russian government of Irkoutsk, to which it is joined at its northern extremity. On the east it is bounded by the North Pacific Ocean, and on the west by that large gulf called the Sea of Okhotsk. The country is of a very unequal surface. A chain of elevated mountains with numerous lofty peaks extends from north to south along the whole length of the peninsula, from which numerous rivers spring, and find their way to the ocean. The chief of these, and the only stream that is navigable, is the Kamtschatka, which admits vessels of 100 tons burden fifty miles up the stream. The country also contains many lakes of a considerable size, and so numerous that all intercourse between the several parts of the peninsula during spring, summer, and autumn, is effectually precluded. The mountains are volcanic, and of very great height; the most remarkable is one situated near Nijni Kamtschatsk, which, it is said, is visible at the distance of nearly 200 miles, and which, in this case, must rise to an enormous height. This mountain is an active volcano, subject to frequent eruptions, which often continue for a fortnight without interruption, covering the whole country for thirty miles round with ashes to the depth of several inches; torrents of flame and lava continually bursting forth, and melting the snows with which the mountain is at all times covered. The years 1737, 1762, and 1767, were distinguished by dreadful eruptions from this volcano.

The climate is ungenial, and cold to a degree scarcely accounted for by the latitude, and is probably owing to the snow-clad mountains, and to the heavy rains and still heavier fogs which settle upon this land from the seas by which it is surrounded. Winter may be said to occupy more than one half of the year, the snow lying upon the ground for seven or eight months; spring and summer the other half. The winters are not so severe as in Siberia, the thermometer never descending in the southern parts of the peninsula below 20° of Reaumur, and seldom below 12° and 15°. Spring is the finest season of the year, the summer being extremely disagreeable, owing to the rains and fogs already mentioned. The greatest heat is in July, when the thermometer is 27° and 28° of Reaumur. Owing to the absence of heat, the variable nature of the climate, the prevalence of rain and of heavy fogs, and to the short and imperfect summer, joined to the stony character of the soil, the country is unproductive, and can hardly be made to yield grain even in the smallest quantity. Its produce is confined to wild vegetables. Wild berries, wild garlic, and roots abound, and greens, turnips, and radishes might with care be everywhere produced. One of the most valuable productions is a root called *duranne*, which grows wild, and supplies in some degree the place of bread; also a plant called sweet grass, which is used in cookery, and from which a spirituous liquor is distilled, equal in strength to brandy. The trees are numerous, though stunted in their size; the birch is most common, also the willow and some kinds of dwarf pines and cedars. Shrubs are more plentiful. But the chief riches of Kamtschatka consist in the variety and abundance of wild animals which range over its unproductive wastes, and in the great numbers of fish which swarm in all its rivers. The animals of the chase are found in prodigious numbers; and, as in all cold climates, they are provided with a covering of the richest furs. The animal from which the sable is procured is even more plentiful than in Siberia, though the fur is not quite so beautiful. There are several species of the arctic fox, particularly one called the *ognefka*, or the fiery-red fox of Kamtschatka, which is the finest species. The other animals are the beaver, the hare, the marmot, sea and river otters. Bears, wolves, rein-deer, and mountain sheep, and sometimes a few lynxes, are to be found; and hunting, especially of the bear, constitutes one of the chief occupations of the Kamtschadales. The dogs of Kamtschatka, which are trained to useful occupations, are much valued. These faithful animals are employed to transport fish, supply the house with water and the cattle with hay, and to do all the work for which horses are employed in England. They are fed well or ill according to circumstances, but are always left to shift for themselves from June to October. They are of a coarse appearance, in shape resembling the common house-dog; but are endowed with uncommon sagacity. The fish, which swarm in the rivers and around the coasts, supply the chief article of food to the inhabitants. The salmon, herrings, and different kinds of shell-fish, are of particular excellence; and great benefit accrues from the numerous whales which are cast upon the shores. Independently of fish and wild animals, the Kamtschadales derive also a considerable benefit from the surprising quantities of geese, ducks, swans, snipes, and wild cocks, which are found in their country. They are preserved either by salting, or by being dipt in water, which freezes and keeps them fresh whilst the winter continues. The ducks and snipes are excellent; also the geese, swans, and wild sheep, which are considered as venison. With all these resources for their subsistence, fish, flesh, and fowl, wild berries, and roots in great variety and abundance, with immense quantities of furs of the warmest and most durable kind for clothing, and, for firing and building, wood in profusion for their limited wants, the inhabitants of Kamtschatka have an ample supply of the necessaries of life placed at their disposal.

The inhabitants of this peninsula formerly lived in the filthy and famished condition of savages, and since they have come under the dominion of the Russians they are not greatly improved; so difficult is it to change the moral habits of a people. They are in general of low stature, with broad shoulders and a large head and short legs; the face, and particularly the nose, long and flat, with small and sunk eyes, thin lips, and scarcely any beard, which is a complete Tartar portrait, both in figure and features, and proves them to have sprung from this great Asiatic stock. They are now, as mentioned by Captain Cochrane, who traversed so large a portion of Asia on foot, established in villages, all built in the old Russian style, which are clean and comfortable. During the summer or fishing season they leave their winter residences for the places which they use for drying fish. The summer is thus occupied in providing food for the winter, which is mostly employed in the chase. But though the above traveller represents the inhabitants of this wild and inhospitable country as amiable and honest in their dispositions, he still characterises the Kamtschadale, after providing his winter store, as being, beyond this, "the same lazy, drunken, servile animal as formerly."[1] Their ancient language is not forgotten, though most of them speak the Russian. The number of real Kamtschadales who retain their ancient usages is small. They reside on the northern coasts, beyond Tygil and Nijni Kamtschatsk. Hospitality, the virtue of all rude nations, is the most striking feature in their character, though they are also remarkable for their strict adherence to truth. Their character is represented by other travellers as mild and hospitable, living together in general in great harmony, and even, when necessary, notwithstanding their usual habits of laziness, assisting each other in their labours. They are a healthy race, enjoying, notwithstanding the rudeness of the climate, great vigour of constitution, so that they are subject to but few maladies, and generally reach an advanced age. Since they have been subjected to the Russian dominion, they are prohibited from going to war, though formerly wars were frequent amongst them, and were carried on with all the characteristic cunning and cruelty of savages. It was not their common practice to engage in regular battle, but the hostile parties laid ambuscades for each other; and when they succeeded they killed the men and children, and carried off the women. Sometimes a party, surprised by their enemies, would, in their desperation, first kill their women, and then themselves. Their arms are clubs, lances, and arrows pointed with bone. Now that they are compelled to remain at peace, they have sunk into indolence and the coarsest sensuality; they devour their fish, which is their principal food, raw, with eager avidity, and without the slightest regard to cleanliness or delicacy. Salmon is their greatest delicacy, and they bury it in the ground till it become putrid, when they consider it as in the best state to be eaten. Their whole habits, both in eating and in every other part of their domestic economy, are filthy in the extreme; no part of their body is ever washed, neither their face, hands, nor

[1] *Narrative of a Pedestrian Journey through Russia and Siberian Tartary*, by Captain John Dundas Cochrane, R. N. vol. ii. p. 42.

feet. Their manners, however, are lively and cheerful; they delight in dancing, which causes them entirely to shake off their natural indolence; their songs are full of rude mirth; they have agreeable voices, though their tunes are very rude; and they are fond of feats of mimicry, in which they excel. One of their favourite dances is the imitation of the gestures and attitudes of a bear in moving quietly along, or in the act of seizing its prey. All these they represent to the life; and in the distortions into which they throw themselves in order to perform these uncouth exhibitions, they undergo a degree of labour which astonishes all travellers, considering their natural indolence and aversion to all bodily exertion. The admiration which the spectators express on beholding these performances, rude as they are, is unbounded. These social meetings of the Kamtschadales are not always, however, the most pure. Licentiousness prevails, and the females are by no means scrupulous in their conduct. It is their practice to go out at a particular season to collect roots and vegetables for winter consumption; and they celebrate this time, which is a holiday festival, with all the unbounded license of bacchanalian revellers. Like all rude nations, they are extremely superstitious. They formerly relied for aid, in all extremities, on their own priests, the Shamanes; but they have now transferred their veneration to the Russian priests, to whom they give presents of furs, whilst all that was exacted by the former for their spiritual aid was a hearty meal.

The Kamtschadales had formerly their winter and their summer habitations, the former sunk some feet under ground for the sake of warmth, the walls formed of trees laid over each other and plastered with clay, the roof slanting, and covered with coarse grass or rushes: their houses now exactly resemble those of their conquerors, and a Kamtschadale is a counterpart of a Russian village. It is extremely dirty and uncomfortable, and the intercourse with the Russians has in no respect reformed the original habits of the inhabitants. The dirt, and stench, and soot, issuing from the lamp of a Kamtschadale cottage, are what only a native could endure. "They seem," says Cochrane, "a race disburdened of all care and consideration for the future, and are entirely resigned to any fate which may await them, whether it be oppression, starvation, or disease." The summer house is raised to the height of twelve or thirteen feet from the ground, by a number of posts, which support a platform made of rafters and covered with clay, which serves as the floor, whence the house ascends in the form of a cone, covered with thatch or dried grass; and here the whole family eat and sleep. The purpose of raising up the house upon these posts is to afford a space sheltered from the sun and the rain, where they can conveniently dry the fish, which are accordingly attached to the posts and ceiling for this purpose.

The Kamtschadales have few domestic animals. According to the last census, Captain Cochrane informs us that the number of horses throughout the whole peninsula did not exceed 109, and the number of horned cattle 968, two thirds of which are in the hands of the Russians, and about 400 head of cattle in the possession of 3400 Kamtschadales and Koriaks. The cattle left by Captain King have not multiplied as was expected, which is a great loss to the inhabitants, as the introduction of horses and horned cattle would tend to ameliorate the condition of the people. The extensive meadows of Kamtschatka would afford ample pasture for large herds of cattle, nor is the climate too severe; and the neglect, therefore, of supplying the country with these is ascribed by Cochrane to the interested views of the Russian chiefs, more intent on their own selfish objects than on the public good. At present, the large species of dog, which rather resembles the mountain or shepherd dogs of Europe, is the only beast of burden which the inhabitants use; and there is no individual, either Russian or native, who has less than five. These dogs are harnessed to a sledge, two and two abreast, with one peculiarly well trained and intelligent placed in front as a leader. They have different cries to encourage and spur them on, or to direct their course. The cry of "tag, tag," turns them to the right; that of "kongha, kongha," to the left; "ah, ah," stops them; and "ha" hastens their departure. A sledge for personal convenience is drawn by four or five dogs, one for baggage by ten. The travelling sledge is in the form of an oblong basket, three feet in length and one foot in breadth, and raised three feet from the ground; and both extremities are elevated in a curve. On this vehicle the rider sits astride, or more commonly sideways; and it is reckoned the perfection of charioteering to drive standing on one foot. Whilst the vehicle is passing over uneven ground, it is extremely difficult to maintain the balance; and inexperienced riders are consequently in great danger of being thrown out and of overturning the carriage. The only instrument they use is a stick, which they throw at the dogs, and catch again with amazing dexterity.

Of the origin and history of the Kamtschadales we have no accurate accounts; and very little is known of them beyond the last 130 years. The country was visited in 1649 by some Russians, whose vessel was wrecked on the coast. They lived in peace with the natives for a considerable time; but afterwards quarrelling among themselves, were murdered. It was not till the year 1696 that a body of Cossacks from Anadirsk penetrated into the country. From that time they were involved in perpetual hostilities with the natives. Successive expeditions were sent into this inhospitable country, and the Russians advanced farther and farther, erecting forts and levying tribute, until all Kamtschatka was, in 1706, surveyed and occupied by them. From this period it has been governed by Russia; and though the sway of the emperor has been mild, yet the inhabitants have been severely oppressed by their own magistrates, each of whom is a petty despot within his own district. Each ostrog or district is permitted to choose its own magistrates, the chief of whom is called a *toion*, who is merely a peasant like those whom he governs, and has no outward mark of distinction. He has another magistrate under him, called *yesaoul*, who assists him in his functions, and in his absence acts as his deputy. These magistrates have a general charge over the peace of the district; they are besides collectors of the tax, and possess large discretionary powers, which they often abuse in oppressing the inhabitants. The *yasack* is an inconsiderable pecuniary tax, which is paid by a contribution of furs from each village, but is rendered odious and oppressive from the arbitrary manner in which it is collected. The furs are often undervalued, especially if the toion or chief of a village does not properly compliment the chief officers on his annual visit. Cochrane mentions that he had seen sables valued at 2s. 6d., for which merchants would have given 12s. These furs, though of the finest quality, and worth 40s. a pair, are never averaged at more than 10s. This tax is payable to the emperor, and also to his deputies; so that, by their arbitrary exactions, it is often paid five times over. Besides this, there is a capitation tax of 7d. on each individual; and to enforce the collection of this tax the most arbitrary measures are often employed. The property of defaulters may be seized and sold in a moment; such as axes, knives, nets, guns, kettles, or the clothing of the family; and it has often happened that the poor natives are ruined by the illegal dues added to this tax by the collectors. There are other oppressions to which the inhabitants are liable, namely, forced and gratuitous services, such as forwarding of the post, the transport of flour and salt, and the forced levies of horses or dogs to officers and favourites. Any favourite or officer, who may wish to trade, is furnished with a free billet, which authorizes him, on the plea of public duty, to call out any supply of men and dogs that he may deem expedient; and besides this, he may purchase as many sables as the poor native happens to possess, and at any price which he himself chooses to fix.

The trade carried on with Russia consists in the exchange of furs for such articles as are in demand amongst the inhabitants. Captain Cochrane estimates the annual number of animals caught in the peninsula at 30,000, worth at least 200,000 rubles, or L.10,000. For these are received bread, flour, oatmeal, tea, sugar, tobacco, coarse cottons, nankeens, ribbons, handkerchiefs, &c.; woollens, linens, axes, knives, kettles, twine, &c. But the article most desired by the inhabitants, and which is ruinous alike to their morals and their health, is spirits, supplied to them by the Russian traders. For a glass of spirits these miserable creatures will sell the last sable they are possessed of. No less than 16,000 bottles of this pernicious stuff are consumed in the short period of three or four months, by 600 or 700 people, and at a most exorbitant price. This, with the introduction of European vices, carrying with them the seeds of other diseases, has contributed greatly to the desolation of the country. The population was greatly thinned by continual wars and insurrections; and these were followed by the introduction of the small-pox, which, in the year 1768, carried off no less than 6000 persons. Vaccination has been introduced, but a want of vaccinating matter has prevented this improvement from being generally introduced. St Peter's and St Paul's is the chief city of Kamtschatka, which contains forty-two dwellings, besides fifteen edifices belonging to the government, an old church, and the foundation of a new one. There is a school in this place, governed by a priest and a regular schoolmaster; but they are neither of them highly qualified for their duties. The children of the natives receive no education, and the children of the Russians but little more. The number of convicts who are sent here is also a serious grievance, as they obtain an ascendency over the natives, which is exercised in a most intolerant and infamous manner. They frequently desert, and commit every species of villany and outrage, even to the fomenting of insurrections.

Kamtschatka has been divided, since 1783, into four districts: 1*st*, Bolcheretsk; 2*d*, Tiguilok; 3*d*, Nijni Kamtschatsk; 4*th*, Verschnei Kamtschatsk. Since 1802 a commandant-general or governor has been appointed over the peninsula, who formerly resided at Versehnei Kamtschatsk, but has since been removed to St Peter's and St Paul's, and is, says Cochrane, again to be removed. According to his account, no improvement can be brought about in the condition of this desolate country, as long as its governors are sent for five years only. The general mode of occupying the allotted term, he adds, is for the first year to look about and to form plans for the improvement of the country, the second is passed in making reports, stating opinions; the third year brings the reply of the government, directing or authorizing the mode of administration; the fourth is employed in preparing, or at most in acting upon, such orders; and the fifth and last year in preparing to return to Europe, and in levying a parting contribution; the whole five years being indeed taken up more or less with accumulating as much money as possible. The population of Kamtschatka, according to the last census, amounts to 2208 Kamtschadales, 498 Koriaks, and 1260 Russians, amounting, along with the addition of other straggling hordes, to 4574 men, women, and children. (F.)

Islands in the Sea of KAMTSCHATKA. See ALEUTIAN ISLANDS.

KAN, or KHAN, the name of an officer in the East, answering to that of governor in Europe. There are khans of provinces, countries, and cities, who have different additions to distinguish them.

KANANY, a group of small uninhabited islands in the Eastern Seas, lying off the north coast of Mysol, about the 130th degree of east longitude. Good water may be procured at the south end of the great island. These islands produce a species of nut, full of oil, and about the size of a small almond. The north point of the principal island is fixed in long. 129. 36. E. and lat. 1. 47. S.

KAN-CHOO-FOO, a city of China, of the first rank, in the province of Kiangsi, situated at the confluence of two rivers, one of which has very high banks. A bridge of boats, fastened with iron chains, crosses these rivers at the union of their streams; and a stone quay extends for some distance, with handsome landing places. This town includes twelve others in its jurisdiction, and its neighbourhood produces abundantly the varnish trees. Long. 114. 30. E. Lat. 25. 52. N.

KANDAHAR. See CANDAHAR.

KANDERN, a town, the capital of a bailiwick of the same name, in the circle of the Treisam, in the duchy of Baden. The bailiwick contains, besides the town, fifty-four villages and hamlets, and 12,800 inhabitants. The town is situated on the river Kandern, has some considerable iron-works, and contains 144 houses and 1527 inhabitants.

KANGAROO ISLAND is situated on the south coast of Holland. It was discovered by Captain Flinders, and was so called from the great number of kangaroos found on the island, which were so tame that they suffered themselves to be knocked down with spikes. The soil, as far as it was examined by Captain Flinders, appeared to be fertile, and the country was covered with a thick wood. Long. of Kangaroo Head, 137. 58. E. Lat. 35. 43. S.

KANGELANG ISLE, an island of a very irregular shape, and surrounded by a cluster of smaller ones, with innumerable shoals. The principal island is twenty-five miles long by eight in average breadth. It is situated between the sixth and seventh degrees of south latitude, and the 115th and 116th of east longitude.

KANGRAH, called also Catochin, a district of Hindustan, in the province of Lahore. It is bounded on the north and north-west by Hurreepoor, on the east by Chambay, on the south by Calour, and on the west by the Punjab, being situated to the south-west of the Himalaya Mountains, between the Beyah and the Rauvy Rivers. The country is covered with wood. The fortress of Kangrah, which is situated in the northern part of the province, has long been celebrated. It was taken, A. D. 1010, by the famous Mahmoud of Ghizni, who plundered it of immense riches. It was retaken by the rajah of Delhi in 1043; and afterwards by the Emperor Akbar, after a very long siege, who conferred it on one of his officers, with the adjoining district. From him the present possessors of the lands boast their descent. It is situated on the top of a steep mountain, is well supplied with water, and contains ample space for raising supplies to feed a numerous garrison. Like all the other hill-forts in India, it is very unhealthy. Long. 75. 50. E. Lat. 32. 20. N.

KANIJEE, a small town of Hindustan, in the province of Gujerat, situated a few miles north from Rahdunpoor. It contains about 250 houses, and is surrounded by a ditch eight feet deep, and a good parapet.

KANKHO, or KANKIANG-HO, a large river of China, in the province of Kiangsi. Its course is from north to south, and it falls into the Poyang Lake, forming the termination of the great water communication reaching from Pekin southwards for upwards of 1000 miles. It has a rocky bed, and the navigation is sometimes dangerous.

KANOGE, a town and district of Hindustan, in the province of Agra. The district extends along the east side

Kanoge. Kant.

of the Ganges, and is generally of a sandy soil, though well cultivated. The town is of great antiquity and celebrity, about two miles distant from the Ganges, with which it communicates by a canal. It was in former times of much greater extent and magnificence; and, for an extent of about six miles, the small pieces of brick which are seen on the spot, and the occasional traces of building, mark out the site of the ancient capital of Hindustan. The town at present consists of but one street; there are no buildings of any consequence; and the brick walls, which appear of no great antiquity, are going rapidly to decay. The adjacent plain is covered with ruined temples and tombs, and everywhere broken images are seen lying under the trees. The most curious remains of antiquity are often found amongst the ruins, such as ancient coins, inscribed with Sanscrit characters, and sometimes with the figure of a Hindu deity on one side. Kanoge was the capital of a powerful empire which existed at the period of the Mahommedan invasion. It was conquered, though not permanently retained, by Mahmoud of Ghizni, A. D. 1018. The travelling distance from Agra is 217 miles; from Lucknow, seventy-five miles; from Delhi, 214; and from Calcutta, 719. Long. 79. 52. E. Lat. 27. 5. N.

KANT, IMMANUEL, a very eminent metaphysician, and the author of that theory which has been distinguished by the name of the *Critical* or *Transcendental Philosophy*, was born at Königsberg, in Prussia, on the 22d of April 1724. Of his paternal ancestors little is known with certainty; but tradition represents them as having sprung from an emigrant Scotchman of the name of Cant; and the philosopher himself, who frequently alluded to this traditionary extraction, is said to have been the first of his family who changed the initial letter of his name to K, with a view to adapt it to the German pronunciation.

The father of Kant, who exercised the humble profession of a saddler or harness-maker, in the suburbs of Königsberg, was distinguished rather for his integrity and respectability than for his wealth. His mother appears to have been a woman of considerable talent, and of a more decided character. She was exceedingly pious, and much attached to the strict religious tenets and discipline of Dr Schultz, a divine who at that period enjoyed a high reputation for learning, eloquence, and piety.[1] Kant uniformly spoke of both his parents, but especially of his mother, with feelings of the warmest affection.[2]

Although far from being in affluent circumstances, his parents resolved to bestow upon their son Immanuel every advantage that could result from a liberal education. Accordingly, after having been taught to read and write at the charity school of the suburbs, he was sent, in the year 1732, to the *Collegium Fridericianum*, at the suggestion, it is believed, of Dr Schultz, who, even at that early period, had the penetration to discover the talents of the boy. At this school he contracted an intimate friendship with Ruhnkenius, afterwards so celebrated for his philological attainments, which was maintained by occasional correspondence during the remainder of their lives, and which, in their early years, may naturally be supposed to have had a salutary influence on the studies of both. They were both indefatigable students; and they not only mutually assisted each other in their school exercises, but read together, during their leisure hours, whatever books their inclination led them to peruse, or their circumstances permitted them to purchase. It is rather a remarkable circumstance, however, that at this early period Kant devoted his attention principally to philological studies; whilst his friend Ruhnkenius seemed to be attracted, by an apparently natural tendency of disposition, to the cultivation of philosophy. In their maturer years, as is well known, these early predilections were precisely reversed.[3]

Having completed his preliminary education, he repaired, in the year 1740, to the university of his native town, where he applied himself with great ardour to the study of the mathematical, philosophical, and theological sciences. Amongst the professors of Königsberg, several of whom were men of considerable talents and attainments, he appears to have attached himself particularly to Professor Martin Knutzen, well known, at that period, as the author of several useful works, to whose instructions in mathematics and philosophy Kant acknowledged himself to have been greatly indebted.[4] To the great diligence and success with which he prosecuted his studies at this period, his early writings bear ample testimony. The youth who, at the age of twenty-two, could boldly and successfully impugn the doctrines of Leibnitz and Wolf, and skilfully wield the weapons of dialectics against the authority of the most eminent metaphysicians of his day, must have bestowed no common pains in the acquisition of scientific knowledge, and in cultivating the powers of his understanding. From the earliest period of his career, too, he was left almost entirely to the resources of his own talents and prudence, and compelled, at every step, to struggle against the depressing influence of poverty. When scarcely arrived at manhood, he had the misfortune to lose both his parents, who had not the satisfaction of living to witness the fruits of their son's talents and industry. They, indeed, had never been able to afford him much pecuniary assistance; but he was fortunate in meeting with some relations of his family, who were in more affluent circumstances, and by whose liberality, combined with his own exertions and economy, he was enabled to continue the prosecution of his studies.

After a residence of about three years at the university, he acted in the capacity of private tutor in several families, and lived about nine years with the Count de Hüllesen at Arnsdorf. During this period he embraced the opportunities which his retirement afforded him, of collecting a vast store of general knowledge in almost every department of science and literature, and of sketching the outlines of several of those philosophical treatises, which were soon afterwards published in rapid succession.

It is rather unfortunate that no record seems to have been preserved of the course of his studies during this most interesting period of his life; nor has he himself, so far as we know, left any memorials which might enable us to trace the gradual progress of his mind in the acquisition of knowledge. It is certain, however, that he both read and thought much. According to his own confession, he was not particularly well qualified to discharge the duties of a tutor; being always too deeply engaged in acquiring and digesting knowledge in his own mind, to be capable of communicating the rudiments of it to others. His mind seems to have originally entertained a strong bias towards mathematical and physical researches; and

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[1] He was professor of theology at the university of Königsberg, and the author of several works which were much esteemed in their day; amongst others, of a work on the *Elements of Metaphysical Science*.

[2] Kant had several sisters, and an only brother several years younger than himself, who took orders, and had a living in Courland, where he continued to reside until his death.

[3] Throughout every period of his life, however, Kant retained a great fondness for classical literature. He was particularly partial to the study of the Roman writers; and, even in his old age, he delighted to have an opportunity of reciting and applying passages from the works of his favourite authors.

[4] Knutzen died in the year 1756, as extraordinary professor of philosophy at Königsberg.

he exhibited some specimens of knowledge, acuteness, and originality of investigation, in the latter branch of science, from which much eminence might have resulted had his views been exclusively confined to that department.

It was probably during the period of his retirement at Arnsdorf that he was led to engage in a laborious investigation of the various metaphysical theories of ancient and modern times. With this view, he made himself master of the living languages, especially the French and English, the latter of which he acquired without the aid of a master, in order to enable him to examine into the merits of the British philosophers, particularly Locke, Berkeley, and Hume. To the sceptical conclusions of the last-mentioned writer, according to Kant's own confession, the world is indebted for the *Critical Theory*.

Having attained his thirtieth year, and already distinguished himself as the author of several tracts, exhibiting great originality of thought, Kant resolved to devote himself to the profession of public teacher. With this view, he returned to the university of Königsberg, and took his degree of master of arts, according to the usual forms, in the year 1755. It was upon this occasion that he produced, in the form of an inaugural dissertation, his tract entitled *Principiorum primorum Cognitionis Metaphysicæ nova dilucidatio;* the first of his works, it is believed, which contained any hints respecting his peculiar views of metaphysical science. In the same year he published his celebrated treatise on the *Universal Natural History and Theory of the Heavens; or an Essay on the Constitution and Mechanical Structure of the whole Globe, according to the Newtonian System.* In this treatise, by following out the principles of Newton, he was led to anticipate, in theory, some of the subsequent discoveries of the great practical astronomer Herschel.

Soon after he had taken his degree, he began to avail himself of the privilege attached to the character of a *Doctor docens*, by delivering lectures publicly on logic, metaphysics, mathematics, and natural philosophy; to which, at a subsequent period, he added the law of nature, moral philosophy, natural theology, and physical geography. He had not long commenced the discharge of his duties as a public teacher, when the concourse of students, whom the reputation of his profound and extensive learning attracted, was so great, that his *auditorium*, or lecture-room, although large and commodious, could scarcely contain the numbers who eagerly flocked to hear him. His affable manners and social talents, at the same time, rendered him a most acceptable guest at the tables of the most respectable inhabitants of Königsberg, with several of whom he lived on habits of intimate friendship.

But notwithstanding his acknowledged talents as a philosopher, and his popularity as a lecturer on scientific subjects, it was long before Kant obtained any preferment. With a mind constantly and intensely engaged in the pursuit of knowledge, he appears to have possessed no ambition beyond that of being useful in the sphere he had chosen for the exercise of his abilities; and he had too much simplicity of character to resort to any of those arts by which other men, more emulous of distinction, frequently endeavour to advance their worldly interests. Upon the death of Knutzen, in the month of April 1756, he solicited the vacant extraordinary professorship of philosophy, but without success. The ordinary professor of logic and metaphysics having died in 1758, Dr Schultz, who, as we have already observed, discovered at an early period the talents of Kant, and continued to patronise him so long as he lived, exerted all his influence to obtain that situation for his *protegé*. But Kant was again disappointed. Not discouraged, however, by the repeated failure of his attempts to attain independence, he continued to deliver his lectures, and to meditate his writings. In the month of February 1766 he accepted the unsolicited situation of second keeper of the royal library, to which a small salary was attached; and at the same time he undertook the management of a private cabinet of curiosities. But these offices he resigned in 1772, on account of the interruptions to which he was exposed in showing the books and rarities to strangers.

In the year 1770, Kant at length attained the highest object of his ambition, on his advancement to the ordinary professorship of logic and metaphysics in the university of Königsberg; a situation which, while it placed him far above the fear of want, afforded him, at the same time, the best opportunity of employing his talents in a manner satisfactory to himself and advantageous to his country. Upon this occasion, he produced his celebrated inaugural dissertation, *De Mundi Sensibilis atque Intelligibilis Forma et Principiis*, in which he propounded some of the fundamental principles of that metaphysical theory to which he was afterwards indebted for his great reputation.

From this period, the life of Kant affords no very remarkable incidents for the pen of the biographer. His time appears to have been chiefly occupied in the faithful and zealous discharge of the duties of his office; in the composition of those philosophical works, by which he hoped to accomplish an important and beneficial reform in metaphysical science; and in cultivating the society of a select number of friends. At this time, too, he maintained a philosophical correspondence with several of the first literary characters of the age, and particularly with the celebrated Lambert, then president of the Royal Academy of Sciences at Berlin, whose views of philosophy were, in some respects, coincident with his own. His letters to Lambert, indeed, are peculiarly interesting, as they contain frequent allusions to the gradual development of his metaphysical ideas.

In the year 1780, he became a member of the *Senatus Academicus;* and in 1787 he was admitted a member of the Royal Academy of Sciences at Berlin. Never, perhaps, did there exist a mind so ardently and so entirely devoted to the cultivation of science, and so utterly divested of all interested motives in the pursuit of knowledge. Having once attained independence, his ambition, as to worldly objects, seems to have aspired no higher. Although he received, at different times, various invitations, with most advantageous proposals, to induce him to transfer his talents and his reputation to other universities, he could never be prevailed upon to leave his native town; being perfectly satisfied with the advantages he already enjoyed, and with the sphere of usefulness which had been assigned him. For many years previous to his death, he was the senior professor of Königsberg; and he enjoyed that high degree of respect and veneration which was due alike to his advanced age, his eminent talents, and conspicuous virtues. He died, by a gradual decay of nature, on the 12th of February 1804, in the eightieth year of his age. His funeral was attended by the most respectable inhabitants of Königsberg, and by a numerous train of his friends and disciples; and, to express the public regret for the loss of so distinguished a character, the whole city put on mourning. On his coffin there was placed a sepulchral urn, with the inscription, *Cineres mortales immortalis Kantii.* A beautiful commemorative medal was also executed upon this occasion, by M. Abramson of Berlin. On one side is a striking likeness of the philosopher, with the inscription, *Immanuel Kant, nat.* 1724. On the reverse, the artist has attempted to express the services of Kant in assigning limits to the province of speculative philosophy, by representing a Minerva seated, and holding an owl in her right hand, which she prevents from flying, with the inscription, *Altius volantem arcuit.*

In his person, Kant was rather below the middle stature, of a slender and delicate form, and with a very narrow and flat chest. His bodily frame, indeed, did not seem to promise longevity; nor would he, in all probability, have attained so great an age, had not his constitution been preserved by his regular and temperate mode of living. In his external appearance, strangers found nothing prepossessing, or indicative of any uncommon talents; on the contrary, his features are represented by a gentleman who visited him at Königsberg, as "a reproach to physiognomy." Others, however, describe his countenance as full of dignity, and expressive of benevolence. His natural disposition was cheerful and social, and his manners were polite and affable. He exhibited none of that awkwardness or reserve which is frequently generated or increased by habits of recluse meditation, and which is often thought to be characteristic of the scholar and man of science. He loved company, and was both inquisitive himself, and fond of communicating his own knowledge and opinions upon all subjects. There was nothing, however trifling it might appear at first sight, which did not suggest to his mind some interesting reflections; and he could talk as fluently with a lady on the minutiæ of female dress, the mysteries of the kitchen, or the common occurrences of the day, as he could with a philosopher on the most abstruse points of science. He was very regular in his habits. He rose early, and his mornings were generally devoted to study and professional duties, his evenings to society. As he never entered into the married state, he was not encumbered with the cares of a family. He used to say, that when he would have married, he had not fortune sufficient to maintain a wife; and when he possessed the requisite fortune, he had no inclination to marry. It has been remarked that he was fond of society; and during the earlier part of his life, when otherwise disengaged, he used to dine at the ordinary of the principal tavern, by which means he had an opportunity of acquiring an extensive knowledge of human character, and, at the same time, of gratifying his inquisitive disposition, by eliciting from travellers of different countries many curious and valuable observations on the manners, habits, and literature of various nations. He possessed an intimate knowledge of geography, and even of minute topography, probably in a great measure derived from this last-mentioned source, as well as from his private reading of books of travels, to which he was always extremely partial; and he frequently entered into local details with a degree of correctness which could not fail to astonish those who learned that he had never moved fifty miles from his native town. At a later period of his life, when more easy in his circumstances, he generally invited a few of his friends to dinner, with whom he relaxed from his graver studies, frequently enlivening his discourse with sallies of wit and humour, of which he possessed no small share, and occasional irony and satire, of that good-natured species which inflicts no wound on the object against whom it is directed.

Kant's intellectual faculties were of a high order. He had a wonderful power of reflection, which enabled him to unfold the most abstruse principles, and to pursue, in his own mind, a long train of conclusions. He possessed great quickness of observation, and clearness of conception; insomuch that, in conversation, he could describe any object which he had seen, or of which he had read, with admirable precision and accuracy. His memory was exceedingly retentive. He kept no library, but made a contract with a bookseller to send him all new publications, which he perused, and afterwards returned; and the knowledge thus acquired he had always at his command. The most remarkable feature in the moral character of Kant was an utter abhorrence of every species of falsehood, however innocent, and a love of perfect honesty and sincerity in word and action, flowing no less from his natural disposition, than from those high principles which he had early imbibed, of the value of truth, and the dignity of man. In this respect he was ever consistent with himself; and the whole tenor of his long life may be regarded as a practical commentary on his writings, and an exemplification of his moral maxims.

The peculiar doctrines of the critical or transcendental philosophy were not the offspring of impressions accidentally received, and hastily adopted, but the fruit of long, patient, and systematic investigation. Kant, indeed, was well advanced in years before he attempted that reform in metaphysical science which he seems to have long meditated. In several of his earlier productions, and in his letters to Lambert, he evidently appears to have been dissatisfied with the prevailing theories; and his inaugural dissertations, as already mentioned, exhibited some of those peculiar views, which were afterwards more fully developed in his great work, the *Critik der reinen Vernunft.* This work was published in 1781. For several years it appears to have attracted little or no attention; and the publisher, it is said, was on the point of destroying the sheets as waste paper, when a sudden demand rapidly carried off several impressions. From that period, the *Transcendental Theory* began to excite an extraordinary sensation, and to be regarded as a new and wonderful discovery in metaphysical science; the philosophers of Germany were divided into professed partisans and determined antagonists of the doctrines of Kant; and a multitude of publications issued yearly from the press, for the purpose of confirming or refuting the new principles.

It was not long, however, before the *Critical Philosophy* bore down all opposition, and obtained a complete ascendency over the theories inculcated by its adversaries. It was publicly taught in the schools, to the almost total exclusion of the doctrines of Aristotle, Descartes, Locke, Leibnitz, and Wolf; it gave a fresh impulse to the spirit of metaphysical inquiry; and men of the first note in the scientific world felt a conscious pride in being able to comprehend, to explain, to illustrate, to apply, or to extend its principles. It not only effected an entire revolution in German metaphysics, but exerted a powerful influence on works of taste, and the lighter literature of the country. It is impossible, indeed, to comprehend, or to relish, many passages in the works of the more recent poets, novelists, and fugitive writers of Germany, without some previous acquaintance with the doctrines of Kant.

Owing to what has been already said upon the subject in another part of this work,[1] we shall avoid entering into any discussion respecting the merits of the *Critical Philosophy* in the present article; but we shall present our readers with a very concise abstract of its objects and results.

Mr Hume proved very satisfactorily, that our ideas of *cause and effect* are not derived from experience; but he rashly concluded, as Kant observes, "that they are the spurious offspring of the imagination impregnated by custom." Kant discovered that Hume had been led to this hasty inference in consequence of having taken too limited a view of the great problem which he had thus partially attempted to solve. He perceived that the idea of *cause and effect* is by no means the only one which the mind makes use of with the consciousness of its necessity, yet without being derived from experience; but that the science of metaphysics is altogether founded on ideas of a similar nature. He endeavoured, therefore, to ascertain the precise number of these abstract or transcendental ideas; and having succeeded in this to his own satisfaction, he

[1] See *Dissertation First*, Part Second, Section Seventh.

found himself in possession of the whole of those connecting acts of the mind, which constitute the very elements of the understanding itself, which are indispensable to its exercise, and without which the whole of our experience would exhibit nothing but a number of insulated facts, without order or consistency.

The three original faculties, through the medium of which we acquire knowledge, are, *sense*, *understanding*, and *reason*. *Sense* is a passive or receptive faculty. In the objects presented to our senses, we distinguish *matter* and *form*. The forms or conditions of sense are *space* and *time*; the former of the external, the latter of the internal sense. All our knowledge is limited by space and time; for we can perceive nothing that does not exist under these conditions.

Understanding is an active or spontaneous faculty, and consists in the power of forming conceptions. In every conception of the understanding, also, we distinguish the *matter* and the *form*. The matter is the sensible intuition; the form is the unity, or connection, established by means of the synthetic powers of the understanding, or the categories. Kant was at great pains in endeavouring to ascertain the number of these synthetic powers or categories; and he found them to be all comprehended under the four classes of *quantity*, *quality*, *relation*, and *modality*. The categories themselves are twelve in number. Under the first head are comprised *unity*, *multitude*, *totality*; under the second, *reality*, *negation*, *limitation*; under the third, *substance* and *accident*, *cause* and *effect*, *action* and *re-action*; under the fourth, *possibility*, *existence*, *necessity*.

This synthetic power of the understanding is called, in the critical philosophy, its *original* use. The *logical* use, both of understanding and reason, is to be found in the faculty of *judgment*. Logic, however, has only to do with the form of our conceptions, and not with their matter; which last inquiry belongs to transcendental philosophy, or metaphysics.

Reason is the third or highest degree of mental spontaneity, and consists in the power of forming ideas. As it is the province of the understanding to form the intuitions of sense into conceptions, so it is the business of reason to form conceptions into ideas. The ideas of reason are absolute and unconditional, and totally independent of space or time; consequently, we can neither obtain nor extend our knowledge by means of reason alone. For these ideas are nothing more than certain representations of the unconditional, that is, of the highest unity and totality, which spring from the essential constitution of our reason, which serve to render the field of experience a comprehensible whole, and which, therefore, are merely conditions of the exercise of our reason, and not real external objects of which it is possible to acquire any knowledge by intuition.

The results of the critical theory may be stated, we conceive, in a very few words. The first principles, or conditions, of our speculative knowledge, are mere *subjective* forms, or forms derived from the constitution of the thinking being: First, the forms of sense, or pure intuitions (space and time); and, secondly, the forms or notions of the understanding (the categories). These intellectual forms or notions, however, only acquire reality by their application to our perceptions, with reference to possible experience, and therefore we can have no speculative knowledge of things beyond the sphere of experience.

Besides the critical investigation of pure reason in its speculative exercise, Kant instituted a similar inquiry into the nature and laws of our *practical reason*, and of the faculty of *judgment*; and, in the spirit of his own theory, he published the *Metaphysical Elements of Natural Philosophy*, of *Law*, and of *Ethics*. His *Logic*, *Physical Geography*, and some other works, were published by his friends, from his papers, and the marginal notes to his text-books. Towards the latter end of his life, he meditated a work, which was intended to be the key-stone of his whole system, and which was to have been entitled *The Transition from Metaphysics to Physics*; in which he proposed to demonstrate the general application of the principles of the transcendental theory. The decline of his faculties, however, prevented the execution of this projected work.

We shall close this article with a list of Kant's publications.

Gedanken von der wahren Schätzung der lebendigen Kräfte, &c. (Thoughts on the true estimation of the animal powers, with strictures on the proofs advanced by Leibnitz and others.) Königsberg, 1746.

Allgemeine Naturgeschichte und Theorie des Himmels, &c. (Universal Natural History and Theory of the Heavens, &c.) Ibid. 1755.

Principiorum primorum Cognitionis Metaphysicæ nova dilucidatio. A Dissertation on taking his master's degree, in 1755.

Betrachtungen über den Optimism. (Reflections on Optimism.) Königsberg, 1759.

Von der falschen Spitzfindigkeit der vier syllogistischen Figuren. (On the sophistical subtilty of the four syllogistic figures.) 1763.

Einzig möglicher Beweisgrund zu einer Demonstration des Daseyns Gottes. (The only possible evidence for demonstrating the existence of the Deity.) Königsberg, 1763.

Beobachtungen über das Gefühl des Schönen und Erhabenen. (Observations on the feeling of the Beautiful and Sublime.) 1764. This tract is remarkable on account of the spirit of humour and pleasantry which pervades it.

Träume eines Geistersehers, erläutert durch Träume der Metaphysik. (Dreams of a Ghost-seer, illustrated by the dreams of Metaphysics.) Riga, 1766. This publication was occasioned by the visions of the famous Emanuel Swedenborg.

De Mundi Sensibilis atque Intelligibilis Forma et Principiis. Königsberg, 1770. An inaugural dissertation on obtaining his professorship.

These, along with a number of other tracts, in which the author displayed an intimate acquaintance with the principles of the sciences, remarkable quickness of observation, great depth of thought and acuteness of reasoning, will be found incorporated in the following collections.

Kant's Sämmtliche kleine Schriften. (Kant's Smaller Tracts collected.) 3 vols. 8vo. Königsberg and Leipsic, 1797.

Kant's Vermischte Schriften, mit Anmerkungen, von Tieftrunk. (Kant's Miscellaneous Writings, with Notes, published by Tieftrunk.) 3 vols. 8vo. Halle, 1799. A fourth volume was added, Königsberg, 1807.

The early and anonymous essays of Kant were collected and published by F. T. Rink, Königsberg, 1800. In the following works, his peculiar views of metaphysical science, as constituting what has been called the Critical Philosophy, are more fully and systematically developed.

Critik der Reinen Vernunft. (Critical inquiry into the Nature of Pure Reason.) Riga, 1781; 3d ed. 1791, 8vo.

Prolegomena zu einer jeden künftigen Metaphysik, &c. (Prolegomena to every Future System of Metaphysics, &c.) 1783. In the Critik der reinen Vernunft, the author had proceeded synthetically; in this other work he adopts the analytical method, with the view of rendering his theory more intelligible to students.

Metaphysische Anfangsgründe der Naturwissenschaft. (Metaphysical Elements of Natural Philosophy,) 1786. This is a systematic text-book on pure physics, in which the author treats of those principles in natural philosophy of whose truth we are conscious *a priori*, *i. e.* independently of experience. The subject is treated under the four heads of Phoronomy, Dynamics, Mechanics, and Phenomenology.

Grundlegung zur Metaphysik der Sitten. (Fundamental Principles of the Metaphysics of Morals.) 1785.

Critik der Practischen Vernunft. (A Critical Inquiry into the Nature and Laws of Practical Reason.) 1788.

Critik der Urtheilskraft. (A Critical Inquiry into the Faculty of Judgment.) 1790. In this work the author developes his views of the principles of taste.

Metaphysische Anfangsgründe der Rechtslehre. (Metaphysical Elements of Legal Science.) 1797.

Metaphysische Anfangsgründe der Tugendlehre. (Metaphysical Elements of Ethics.) 1797.

Anthropologie, in Pragmatischer Hinsicht. (A Pragmatical Treatise on Anthropology.) 1798.

The following works were published from his papers by his friends:

Logik (Logic), published by G. B. Iäsche, 1801.

Physische Geographie (Physical Geography), of which, we believe, there have been several editions by different editors.

Pädagogik (Pædagogics, or the Art of communicating Instruction.) Published by F. T. Rink, 1803. (K.)

KANTCHEOU, a large town of China, situated near the north-western extremity of the country, where it projects into Tartary. It appears to be the place called Campion by Marco Polo and other early travellers.

KAO, one of the Friendly Islands, in the South Pacific Ocean, called also Aghao, or Oghao. It is two miles north-east of Toofoa, and is a mountainous rock. In the channel which separates it from Toofoa, Captain Cook found no soundings.

KAOLIN, the name of an earth which is used as one of the two ingredients in oriental porcelain. A quantity of this earth was brought from China, and examined by M. Reaumur. He found that it was perfectly infusible by fire, and believed that it was a talky earth; but M. Macquer conceives that it is more probably of an argillaceous nature, from its forming a tenacious paste with the other ingredient, called *petuntse*, which has no tenacity. M. Bomare says, that by analyzing some Chinese kaolin, he found it to be a compound earth, consisting of clay, to which it owed its tenacity; of calcareous earth, which gave it a meally appearance; of sparkling crystals of mica; and of small gravel, or particles of quartz crystals. He says that he has found a similar earth upon a stratum of granite, and conjectures that it may be a decomposed granite. This conjecture is the more probable, as kaolins are frequently found in the neighbourhood of granites.

KAOMING-SZE, a city of China, in the province of Kiangnan, situated on the great canal. It is distinguished by a very ancient and splendid pagoda dedicated to the god Fo. It is sixty-five miles north-east of Nanking.

KAOTCHEOUFOU, a city of China, of the first rank, in the province of Quangtong, situated on a river, thirty-six miles from the sea. It is 200 miles east-south-east of Canton. Long. 110. 4. E. Lat. 21. 40. N.

KAPINI, a small, uninhabited island, about twenty-five miles in circumference, lying off the west coast of Sumatra, and situated almost immediately under the equator. In the charts it is usually named Batu, whilst this latter island is erroneously named Mintaon.

KAPUVAR, a town of the province of Farther Danube, in the Austrian kingdom of Hungary, on an arm of the river Raab, where there is a magnificent castle belonging to Prince Esterhazy. It contains 2943 inhabitants, with one Catholic church. Much tobacco is cultivated around the town.

KARAH, a town of Hindustan, belonging to the Mahrattas, in the province of Gujerat, 17 miles south-east from Ahmedabad. Long. 72. 45. E. Lat. 22. 46. N.

KARAK, an island in the Persian Gulf, the greater part of which is rocky; but the eastern part, being somewhat lower than the others, is capable of being cultivated. It was formerly under the Dutch, when it contained from 2000 to 3000 inhabitants. At present it does not contain above 300 or 400. It affords a safe anchorage at all seasons, but more particularly during the severe gales which blow from the north-west, and are the prevailing winds in this sea. In the year 1808, Sir John Malcolm recommended to the British government to occupy this island, as a defensive position, and a good station for trade, which might be securely carried on with the neighbouring coasts of Persia and Arabia. The Persians are in possession of this island at present. A good supply of water may be procured here, and also the best pilots for Bassorah. Lat. 29. 14. N.

KARAKALPACS, a people of Tartary, who inhabit that tract of country which lies to the east of the Aral, and to the north of the Sihon or Jaxartes. They profess the Mahommedan faith, and are chiefly employed in agriculture, the soil of the country possessing a considerable degree of fertility. The country is under the dominion of khans; but the Seits, the supposed descendants of Mahommed, receive more respect than their princes. The Russians protect them against the incursions of their neighbours the Kirghises.

KARAKITA, a small island in the Eastern Seas, to the south of Sangir, about six miles in circumference. It is cultivated and inhabited. Long. 125. 25. E. Lat. 3. 7. N.

KARANG SAMBONG, a considerable inland town of the island of Java, situated upon a fine river, which is navigable for large prows, and runs through Indramayo into the sea. It is 168 miles south-east from Batavia.

KARASJEE, a small town of Hindustan, in the province of Bejapoor. It contains a number of Mahommedans, who subsist mostly on alms, in a state of filth and sloth. Long. 75. 28. E. Lat. 17. 26. N.

KARASUBASAR, a city of the province of Taurien or Taurida, in Russia, in the circle of Feodosia. It stands in a plain between two mountains, upon the banks of the river Karask. It contains 915 houses in narrow streets, and 3700 inhabitants, consisting of Tartars, Greeks, Armenians, and some Jews, with but few Russians. It has considerable trade in leather, soap, candles, and tallow. Long. 34. 30. E. Lat. 45. 4. N.

KARATSCHEW, a city of the province of Orel, in Russia, the capital of a circle of the same name. It stands on the river Sujeshat. It contains twelve churches, three of which are of stone, 1000 houses, and 6230 inhabitants, who make large quantities of twine and ropes. Long. 34. 51. E. Lat. 53. 16. N.

KARDANAH, a river of Palestine, anciently called Belus, the sand of which has long been celebrated in the manufacture of glass. It falls into the Mediterranean, eight miles south of Acre.

KARGAUW, a town of Hindustan, in the Mahratta territories, in the province of Khandesh, district of Bejapoor. Long. 75. 35. E. Lat. 21. 54. N.

KARGAPOL, a city of the Russian province Olonez, the capital of a circle of the same name, extending over fifty-four square miles, and containing 44,500 inhabitants. The city is built on the river Onega, and is one of the most respectable provincial towns of Russia. It contains seventeen stone and nine wooden churches, two convents, 520 other dwellings, and 3700 inhabitants, who are very active and enterprising. Long. 38. 45. E. Lat. 61. 29. N.

KARICAL, a town of Hindustan, on the sea-coast of the province of Tanjore, fifty miles east by north from the province of Tanjore. The surrounding territory produces rice and salt. Karical was granted to the French by the rajah of Travancore in 1739. The fort is built upon one of the branches of the Cavery, the mouth of which is so choked by a bank of sand, that it is only navigable for boats. In 1760, Karical was taken from the French by Colonel Monson. It has been frequently taken and retaken since that period by the contending parties, and was ceded to the French at the conclusion of the last war. Long. 79. 54. E. Lat. 10. 55. N.

KARLE, a Saxon term, used in our law, sometimes to signify simply a man; and sometimes, with an addition, a servant or clown. Thus the Saxons call a seaman *buscarli*, and a domestic servant *huscarle*. Hence comes the modern word *churl*.

KARLSBAD. This is one of the most celebrated bathing places in Europe. It is situated in Bohemia, on the northern boundary towards Saxony. It is in a narrow and deep valley in a mountainous district, abounding with many most romantic prospects, and stands on both sides of the river Tepel. The springs are said to have been discovered in the year 1358, by the emperor of Germany, Charles IV., whilst hunting; and, the virtues of the water having been ascertained, he built a castle on the spot, around which other edifices were subsequently erected, and thus formed a city. It now contains about 500 houses, with 3000 resident inhabitants; but, in the summer, the number of occasional visitors far exceeds this. It has a neat and well-built church, an elegant theatre, and several spacious halls for assemblies collected for music, dancing, or promenading. The company to be found at this place is of the most promiscuous kind; and monarchs, nobles, and the most distinguished persons on the continent, mix here with the other guests with no observable parade or ceremony. The walks that have been laid out display much taste, and, from several points in them, the prospects are very striking; whilst the number of retreats, where refreshments are furnished, are appropriate, and at very moderate rates. The warm springs are of various names, viz. the Old and New Sprudel, the New Well, the Mill Well, the Bernharts Well, and the Theresa Well. All of these nearly resemble each other in taste, and the patients take very large doses of them. The cures in dyspepsia are much celebrated; and gouty, rheumatic, and scrofulous diseases are frequently cured by the use of the water. The resident inhabitants make many curious articles in iron, steel, tin, and wood, of which most of the visitors become the purchasers.

KARLSTADT, a city of Bavaria, the capital of the bailiwick of the same name, in the circle of the Upper Maine. It is built on the Maine, is surrounded with walls, and contains 460 houses, and 2280 inhabitants.

KARLSTADT, a circle of the Austrian Illyrian province of Trieste, extending over 1326 square miles, containing one city, two market-towns, and 514 villages and hamlets, with 22,400 houses, and 108,250 inhabitants. The whole circle is very mountainous, the southern part being a prolongation of the Alps, and the rest a series of woody mountains. Between the ranges are some extensive and fertile valleys, producing wine, olives, fruit, tobacco, corn, and good pasture. The chief city, which gives its name to the circle, stands on the river Kulp, is fortified, and contains one Greek and two Catholic churches, a Franciscan convent, 524 houses, and 3224 inhabitants, who are employed chiefly in building ships and boats. It is in long. 17. 32. 52. E. and lat. 45. 29. 33. N.

KARNAC, or KARNAK, the name of a village near Thebes, in Upper Egypt, and built on a small part of the site of a temple, which must have been one of the most magnificent in the world. The ruins of this edifice seem to indicate, according to Denon, that it was the largest ever raised by human hands; and he thinks it probable that this temple, as well as the palace of Luxor, was built in the time of Sesostris, called by the Egyptians the Great Rhamses, when Egypt was in the highest degree of prosperity. The plan of this temple is noble and grand; but Denon supposes that the embellishments were added long after the building of the temple, as they exhibit a more correct and chaste style. See article EGYPT.

KARNATA, an ancient Hindu geographical division, which comprehended all the high table-land in the south of India, situated above the Ghauts. The name has been transferred to the adjacent provinces on the sea-coasts of India, Carnatic, and Canara. In the remote periods of Hindu history, Karnata existed as a powerful empire, which comprehended great part of the south of India.

KAROON, a river of Persia, which has its rise about thirty-five miles south-west of Ispahan, at a place called Correng, at the foot of the same hill where the Zeindrood or Ispahan river has its source. After receiving a number of tributary streams in the mountains of Lauristan, it flows through the city of Shuster, to a small village twelve miles to the south of that city, where it meets the Abzal. It then flows with a southerly course as far as lat. 30. 32. N., and thirty miles east of Bassorah. Here it divides itself into two branches, one of which disembogues itself into the sea at Goban; and the other, taking the name of Hafur, after a course of about fourteen miles, again separates, one division passing through an artificial canal three miles in length, into the Shat-ul-Arab, and the other entering the sea by the name of Bamishire. "The Karoon," says Mr Kinneir, "is a noble river, being in many parts upwards of 300 yards in breadth, and navigable for boats of twenty-five tons burden as far as Kishtibund, four miles from Shuster.

KAROULY, a town and district of Hindustan, in the province of Agra, situated on the Putchpuree River, which, ducing the rainy season, swells to a torrent; and on the other side is surrounded by deep and extensive ravines. The town is surrounded by a good stone wall with bastions, and the fort is in the centre. The rajah is of the military tribe of the Rajpoots, who have been gradually stript of their best possessions by the Afghans, Moguls, and Mahrattas. It is seventy miles south-west from the city of Agra. Long. 77. E. Lat. 26. 35. N.

KARPOOT, a large and ancient town of Koordistan, built on the summit of a hill, at the eastern extremity of a fertile valley about three or four miles in breadth and about twenty-five in length. It belongs to the pasha of Maden, or inspector of the mines, who resides at Gebbin Maden, the silver mines on the Euphrates.

KARS, a city of Turkish Armenia, situated at the extremity of a fine valley. It is built on the side of an uneven rocky height, on the summit of which, to the eastward, rises its citadel, of great antiquity. The walls of the town extend in a straight line east and west along the plain; then run up the acclivity of the rock on each side till they reach its top, where, strongly protected with round and square bastions, they meet at the great towers of the fortress. It is a perfect and interesting specimen of an Asiatic fortified city. Beyond the walls, a considerable suburb stretches out eastward; but three or four pentagon batteries, each mounted with five pieces of cannon, appeared to Sir R. K. Porter, who visited this place in 1818, to be the sole defences of the outer town. Seen from a distance, the town has a majestic appearance, from the imposing aspect of its citadel, the extent of its walls, and the height of its towers, which, being mostly of stone, give it an air of peculiar magnificence. But the illusion vanishes the moment the traveller enters the town, which presents an appearance of ruin, dirtiness, and neglect, in all its long and narrow valleys. According to Sir R. K. Porter, Kars is the Charsa of Ptolemy; and being considered as one of the strongest places in this part of the Turkish dominions, is the selected residence of the pasha of the northern frontier. In consequence of its situation as the very key of Armenia towards the north, it has stood a variety of sieges, and endured every change from the varied events of war. The population amounts to about 10,000 families, consisting of Turks, Koords, Armenians, Georgians, Jews, and a few Persian merchants. The place has no great appearance of prosperity. It is thirty miles from Erivan.

KARTAN, or MARTAN, four small islands in the Indian Ocean, near the southern coast of Arabia, at the entrance of the Gulf of Curia Muria. Long. 54. 50. E. Lat. 17. 30. N.

KARTUEL, or KARTALINIA, one of the four provinces which constitute the state of Georgia, and the most western of the whole, bordering on Immeritia. It occupies both banks of the Kur, and comprehends the greater part of the ancient Iberia; but it no longer boasts of the fine cities and handsome public buildings which it contained in the time of Strabo. The repeated revolutions which it has experienced since that period, and, in particular, the destructive inroads of the Lesghaes, have completely changed the face of the country, and almost exterminated its population. The few inhabitants who remain are to be found, as in ancient times, in the southern and middle mountains of Eastern Caucasus. They live chiefly by agriculture, and have their houses almost on the very tops of the hills.

KARUKU, a small island in the Eastern Seas, about three miles to the eastward of Amboyna. This island contains hot springs that will boil an egg. It is principally allotted to the culture of the clove tree.

KASAN, one of the eastern provinces of the Russian empire, which extends beyond the boundaries assigned to Europe by many geographical authorities. It has obtained the name of a kingdom. It was formerly inhabited by a people of the Finnish race, a branch of which, called the Viarmiers, in the most prosperous time of the western Roman empire, had founded a great commercial city at Perm, which flourished till about the year 1236, when this country was conquered by Ghengis Khan. His successors were driven out by some southern Tartars, who, constantly carrying on hostile operations with the Russians, under four different khans, denominated by the names of their respective capitals, Kasan, Astrakan, Kaptschak, and Krim. Unfavourable events induced the khans of Kasan and of Astrakan to make submission, at the end of the fifteenth century, to the Czar Iwan Basilijw I.; and the Russians from that period obtained great influence in the choice of khans over the other two districts. Peace was constantly interrupted between the Tartars and the Russians; and at length the Czar Iwan Basilijw II. conquered, in 1552, the city of Kasan, and in 1554 the city of Astrakan, and the other two were taken possession of by the Russians. The semblance of the Tartar rule was preserved under khans nominated by the czars till 1714, when Peter the Great erected his own government in the city of Kasan, and subjected to it the waywodeships of Simbirsk, Wiatka, Perm, and Pensa. These now form what is called the kingdom of Kasan; but each of the six has its separate government under a stadtholder. The whole extent is given, by authority, at 251,140 square miles, and the population as 5,867,000 persons.

KASAN, a stadtholdership or government of the Russian kingdom of the same name. It extends in north latitude from 54. 13. to 56. 44. and in east longitude from 47. 12. to 51. 39. It is bounded on the north by Wiatka, on the east by Orenburg, on the south by Simbirsk, and on the west by Nishegorod, and is divided into twelve circles or local governments. The whole extent is 22,960 square miles.

The face of the country is undulatory, not hilly, except that, in the south-east, some of the projections of the Ural Mountains enter the province; and on the right bank of the Wolga there are some calcareous hills, more remarkable for the extensive and lofty natural caverns in them than for their height. Being watered by two great rivers and a vast number of brooks and rivulets, and interspersed with woods, meadows, and corn-fields, it has a cheerful aspect, in spite of some districts which are covered with sand or wild heaths. The river Wolga, which runs through the whole province, receives the other streams, and conveys their water to the Black Sea. It is navigable throughout its whole extent, and abounds with fish, particularly with sturgeon, which produce much isinglass and caviare, and form an important part of food for home consumption, as well as for exportation to other districts, though chiefly to Moscow.

The number of inhabitants is 1,293,250, the greater portion of whom are of the Russian race; but there are still many of the Tartar family, and, what appears singular, they are represented as being better instructed than the Russian peasantry. They live in villages by themselves, and have been provided by the government with schoolmasters and books. They mostly practise agriculture, but some engage in handicraft employments, and they are generally peaceable and industrious. The Russians all adhere to the orthodox Greek church, and many of the Tartars have been converted to the same faith; but others of the latter yet retain their profession of Mahommedanism. There are still some remains of the Finnish race, who are a wretched set of people, without information, and generally indolent. There are but few nobles. There are 9200 small proprietors of land, and near 300,000 slaves, the property of the crown.

The husbandry is conducted upon the same plan as in most parts of the Continent, the rotation being a fallow succeeded by rye or wheat in the second year, and these crops by oats or barley in the third year, when the same course is repeated. The corn scarcely yields five times the quantity sown; but enough is raised for bread, as well as for distillation, and some is exported. A large quantity of hemp is grown, and some flax. The woods produce much excellent timber. They mostly belong to the crown, but some of them to private proprietors. There are manufactures both of linen and woollen goods, mostly of a coarse kind, but suited to the climate and the condition of the people. The meadows raise numerous herds of cattle, where hides and tallow are the most valuable of the exports. There are mines yielding copper, and others iron, and from the latter much steel is made. A large quantity of potash is made, and forms a material article of export. The river Wolga is the chief means of transport, and a certain source of commercial occupation and wealth.

KASCHIN, a city of the province of Twer, in Russia, the capital of a circle of the same name, extending over eighty-seven square miles, containing one city and 486 villages, with 75,896 inhabitants. The city is situated on the river Kaschinta, and contains twenty-five churches, 705 houses, and 3813 inhabitants. Long. 37. 35. E. Lat. 57. 20. N.

KASIMOW, a city of the Russian province Riasan, the capital of a circle of the same name, at the junction of the river Babinka with the Oka. It is surrounded with walls, which have been recently converted into pleasant promenades. It has a suburb inhabited by a tribe of Tartars, amounting to 500 persons, having been once the capital of a prince of that people. It contains ten churches, 1800 houses mostly of wood, and 9840 inhabitants. It has considerable trade, chiefly with the Tartars, in furs, and some manufactures of cloth and of earthen ware. Long. 41. 4. E. Lat. 55. 11. N.

KASMARK, a city of the circle of Zips, in the province of the Hither Theiss, in the kingdom of Hungary, and situated on the river Poprad. It contains 493 houses, and 4322 inhabitants, of whom 2619 are Lutherans, the remainder Catholics. It has considerable manufactures of linens, cloths, flannels, and blankets, and good salmon fishing on the river Poprad, which is navigable. Long. 20. 22. 5. E. Lat. 49. 7. 33. N.

KASSON. See KAARTA.

KATCHINS, a barbarous tribe of Asia, on the banks of the Yenisei, in the government of Tomsk, under the jurisdiction of Russia, and who pay tribute to that power. They are altogether pastoral in their habits, dwelling in tents, wandering from place to place, subsisting upon the produce of their herds. About six thousand of their number pay the capitation tax.

KATERLY, a town of Asia Minor, situated on a fine bay of the Sea of Marmora. It is the ancient Drepanum, and is in general a flourishing and populous place, though, at the time of Mr Kinneir's visit, it was almost deserted, in consequence of the plague.

KATTEGATTE, or CATTEGAT, a narrow sea, lying between part of Jutland and the coast of Sweden, and, towards the latter, covered with a great number of islands. It is almost closed at the extremity by the low Danish islands of Zealand and Funen, which, in ancient times, formed the seat of the Suiones. Between the former and the coast of Sweden is the Sound. These islands were anciently called *Codonania*, and gave to the Cattegat the name of *Sinus Codonanus*. Its greatest depth is thirty-five fathoms; but this decreases as it approaches the Sound, which begins with sixteen fathoms, and near Copenhagen shallows even to four. According to Pliny, the Roman fleet, under the command of Germanicus, sailed round Germany, doubled the *Cimbricum Promontorium*, and arrived at the islands which fill the bottom of the Cattegat, and of which, either by observation or information, the Romans were acquainted with twenty-three. One of these they called *Glessaria*, from its amber, a fossil abundant to this day on part of the southern side of the Baltic. A Roman knight was employed by Nero's master of the gladiators to collect in these parts that precious production, and thereby became perfectly acquainted with this country.

KATWYK, a town of the Netherlands, in the province of South Holland. It is distinguished from another place of the same name near it as Katwyk-on-the-Sea. It is celebrated for its sluices, deemed a masterpiece of hydraulic architecture, by which the old Rhine is admitted to the sea. It contains 2750 inhabitants.

KAUFBEUERN, a city of Bavaria, in the province of the Upper Danube, and situated on the river Bertoch. It is surrounded with walls, and contains one Lutheran and two Catholic churches, with 490 houses, and 4630 inhabitants. It has a brisk trade in cotton goods, linens, ironmongery, and paper, and Morocco leather and printed calicoes are also made. Long. 10. 31. 25. E. Lat. 47. 53. 10. N.

KAUKEHMEN, a town of the circle of Niederung, in East Prussia, situated on a canal connecting together the rivers Russ and Gilge. It is in the centre of a parish, which contains 4880 inhabitants.

KAURZIM, a circle of the Austrian kingdom of Bohemia, extending over 952 square miles, comprehending forty-one cities and towns, and 680 villages and hamlets, with 24,197 houses, and 150,609 inhabitants. The capital, a city of the same name, is fortified, and contains 282 houses, with 1520 inhabitants.

KAWSCHANI, a town of the Russian province Bessarabia, the capital of a circle of the same name. It was once the residence of the prince of the Nogai Tartars, and is said then to have contained 20,000 inhabitants, who are now diminished to little more than 2200, chiefly Jews and Moldavians, who live by gardening. Long. 29. 43. E. Lat. 46. 23. N.

KAWUCK, a town of Afghanistan, in the district of Cabul, situated in the Hindu Coosh range of mountains. Long. 69. 30. E. Lat. 35. 40. N.

KAYE'S ISLAND, in the North Pacific Ocean, near the west coast of North America, about thirty miles in length and four in breadth, so named by Captain Cook. The south-western point of the island is situated in long. 216. 58. E. and lat. 59. 49. N.

KAYNS, KIAYNS, or CARIANERS, a singular tribe who inhabit that mountainous and woody tract which lies between Bengal, Aracan, Ava proper, and the province of Munipoor or Cassay. They are represented as a simple, innocent race, speaking a language distinct from that of the Burmans, and entertaining rude notions of religion. Their habits are altogether pastoral, and they are the most industrious subjects of the state. Their villages form a select community, from which they exclude all other sects, and in no case reside in any city, or marry or intermingle with strangers. They profess and practise the doctrine of universal peace, never engaging in war, nor taking any part in contests for dominion. They devote themselves to agriculture, the care of cattle, and the raising of poultry. Almost all the provisions used in the country are raised by this tribe, and they particularly excel in gardening. They have of late years been oppressed and heavily taxed by the great Burman landholders, and have in consequence withdrawn into the mountains of Aracan. They have no written laws, but are guided by immemorial custom, which stands in the place of law. Some learn to speak the Burman tongue, and a few can read and write it imperfectly. They are (says Symes, in his account of his embassy to Ava) timorous, honest, mild in their manners, and exceedingly hospitable to strangers.

KAYOR, or CAYOR, a kingdom of Western Africa, situated on the coast between the rivers Gambia and Senegal. As is the case with many other kingdoms of Africa, correct or recent information regarding Kayor is very limited. According to Golberry, its western limits are the last five leagues of the left bank of the Senegal, adjoining to the mouth of that river, and all the extent of coast comprised between the bar of the Senegal and Point Serene, situated in lat. 14. 44. N. It is bounded on the north by the territory of Wal or Brack, eastward by the dominions of the Bourb Yolof, and on the south by the petty states of Sin and Salum. Extending 150 miles from north to south, by an average breadth of 120 miles, it thus comprises a surface of about 6000 square miles, which is thinly peopled by not more than 180,000 inhabitants. The ground rises imperceptibly from the sea-coast eastward, but without high mountains. The soil is sandy, but fruitful, and bears a number of those immense trees called *baobab*. At the little island of Goree, on this coast, the French have established the capital of all their African settlements. Its advantages consist solely in its almost inaccessible situation on a rock, three sides of which are perpendicular, and the fourth very steep. The rock is fortified, and the town contains about 7000 inhabitants. It is a bustling place, being the entrepôt of all the trade with the opposite coast, and also a place of refreshment for French ships on their way to India. The capital of Kayor bears the same name, and is only a large village, situated about 120 miles from Goree. The sovereign of the country is called Damel, and the government is feudal. The inhabitants are Jalofs or Yolofs, which people are described as the handsomest negroes of Western Africa, being tall and plump, with finely turned limbs, short curling hair, and shining jet-black skin. They are a domestic people, little known beyond their own territories, and recognise amongst themselves the distinction of caste.

KAZAMEEN, a town of Asia, in the pashalik of Bagdad, on the western bank of the Tigris. It contains about 8000 inhabitants, Persians, who have been induced to settle here on account of its being the burying-place of two noted saints, to the memory of whom a noble mosque has been erected. The town is ornamented with two gilded cupolas, supported by the contributions of pilgrims. It has a tolerable bazar, fifteen coffee-houses, three humums, and a caravanserai; and opposite to the town is a tomb of another Mahommedan saint. Nine miles south-west of the town, and at some distance from the river, is the very extraordinary structure which has received the name of the tower of Babel from Europeans, Nimrood from the natives of Bagdad, and Agerkuf from the Arabians. It is 190 feet in height, 100 in diameter; and, from its appearance, Mr Kinneir judged it to be coeval with the remains of ancient Babylon, being built of the same materials, namely, square bricks dried in the sun, cemented with slime and layers of reeds. It is three miles north of Bagdad.

KAZEROON, a town of Persia, in the province of Farsistan. It is situated in a valley about thirty miles long by seven or eight broad, bounded on the north by a salt lake, and fertilized by a number of rivulets of excellent water, producing in consequence abundant crops of grain, which are often destroyed by flights of locusts, the frequent and unwelcome visitors of all the country properly called Persia. It formerly consisted of three distinct villages. It was almost entirely depopulated during the late civil wars. It is now, according to Fraser, a heap of ruins, and does not contain above 3000 or 4000 inhabitants. It is a considerable mart for horses, which are bred in the vicinity, and are highly esteemed on account of their Arab blood. It is celebrated for its wrestlers, and for a class of bird-catchers, who practise a curious mode of taking sparrows.

KEAN, Edmund, a distinguished tragedian, was born at London about the year 1787, but, from the obscurity of his birth and parentage, the exact date is uncertain. His parents appear to have been either actors, or in some manner connected with the theatre, to which young Kean was introduced at a very early age. After appearing in various juvenile parts on the metropolitan boards, particularly in pantomimes, he joined a strolling company in 1804, amongst whom he became actor of all work, and with whom he visited various towns of England, and also Waterford in Ireland. He gradually began to attract attention in his profession, both by his histrionic powers and by his agility of body; for it was very common for him to perform the part of harlequin in a pantomime after he had personated Richard the Third or Shylock. He quitted Ireland in 1810, and became a wanderer on his own account, visiting Dumfries, Carlisle, York, and other places, and by his recitations earning a very precarious livelihood. We pretermit that chequered part of his career which he passed as a provincial actor, and come to that period of it when, having attracted the attention of individuals capable of appreciating his remarkable powers, he was engaged to appear at Drury Lane. This took place early in the year 1814, and the character in which he made his *debût* was that of Shylock. This performance was hailed with great applause, and he repeated it with increasing success, and also added Richard the Third, Hamlet, Othello, and other characters, to the list of those which he personated. Objections were made to the peculiarity of his style of acting, for it formed a complete contrast to that of Kemble, being less dignified, graceful, and elaborately finished, though more impassioned, fiery, and striking in particular parts; but he was very generally recognised as the most brilliant and original tragedian that had appeared for many years. His subsequent career is chiefly marked by a succession of appearances which increased his reputation; and, after the retirement of Kemble from the stage, he was considered as indisputably the first tragedian of his day. By many he was at all times esteemed superior even to Kemble in all the higher walks of the art. He gradually widened his range of characters, but those in which he chiefly excelled were the fine creations of Shakspeare already mentioned. He visited Scotland and Ireland, and in 1818 went to France. A few years afterwards he paid a visit to the United States of America, where he was received with the utmost enthusiasm. After his return to England, a private affair in which he was involved induced him to relax in his professional exertions, and retire for a time to the Continent. On his re-appearance before the public he met with considerable opposition, and failed to reinstate himself in his old position, so that the offer of an engagement in America was gladly accepted by him. Two seasons elapsed ere he again exhibited before an English audience. By the exertion of his rare talents, he acquired vast sums of money; but his prodigality kept pace with his fortunes; and his irregular mode of life having induced a premature decay both of his physical and mental powers, hastened his death, which event took place at Richmond on the 15th of May 1833. As an actor, Kean possessed great pathos, vigour, sarcastic power, and the faculty of creating terror in the highest degree. His intensity in expressing all the passions was extraordinary, but he was often too abrupt, paused too long between his sentences, and occasionally exhibited the bright points of a character instead of the whole. But his Richard, his Shylock, his Sir Giles Overreach, and his Othello, were performances as matchless, and as much his own, as were those of his great rival in Coriolanus and Cato. His figure was diminutive but graceful. His eye possessed remarkable brilliancy and force of expression; and the tones of his voice were highly musical, and capable of the most tender and pathetic expression. His life was published in 2 vols. 8vo, London, 1835.

KEATE, George, was born in 1730, and educated at Kingston School, after which he went to Geneva, where he resided for some years, and became acquainted with Voltaire. When he had made the tour of Europe, he became a student in the Inner Temple, and was called to the bar, but did not meet with such encouragement as to induce him to persevere. In the year 1760 he published his Ancient and Modern Rome, a poem which was received with considerable approbation; and the following year he gave to the world a short Account of the Ancient History, present Government, and Laws, of the Republic of Geneva, 8vo, dedicated to Voltaire, who once intended to translate it into French, but afterwards abandoned his design.

In 1762 he produced an Epistle from Lady Jane Grey to Lord Guildford Dudley; and next year The Alps, a poem, believed to be the best he ever wrote, for truth of description, vigour of fancy, and beauty of versification. In 1764 appeared Netley Abbey; and, in 1765, the Temple Student, an Epistle to a Friend, in which he rallies his own deficiency in application to the study of the law, and his consequent want of success in that profession. In 1766 he published a poem to the memory of Mrs Cibber, of whose talents as an actress he entertained a very high opinion. He married, in 1769, Miss Hudson; and about the same period he published Ferney, an Epistle to Voltaire. Having praised with energy the beauties of that philosopher's poetical works, he introduces a panegyric on Shakspeare, whom Voltaire used every effort to depreciate, probably from a spirit of envy. This eulogium induced the mayor and burgesses of Stratford to present our author with a standish mounted with silver, made out of the famous mulberry tree which is said to have been planted by Shakspeare himself.

In 1775 appeared his Monument in Arcadia, a dramatic poem; and in 1779 he published his Sketches from Nature, taken and coloured in a Journey to Margate, justly allowed to be an elegant composition. In the year 1787 came out The Distressed Poet, a serio-comic poem, in three cantos, occasioned by a long and vexatious law-suit. His last work was perhaps the most creditable of the whole, both to his head and to his heart. Captain Wilson, of the Antelope packet, having suffered shipwreck on the Pelew Islands, was refused any further command, and reduced to distress; a circumstance which induced the humane Keate to publish an account of these islands, for the benefit of that gentleman, which, it is said, brought him about nine hundred guineas in the space of a year. This work is written with much elegance, although it is probable that the manners of the natives of Pelew, in as far as regards their alleged amiability, are somewhat highly coloured.

The life of Keate was spent without any vicissitudes of fortune; he was possessed of an ample estate, which he never attempted to increase, except by prudence in the management of it. He was a man of beneficence and hospitality, and enjoyed in a high degree the favour of his countrymen. He died in June 1797, leaving one daughter.

KEBBAN DAG, a lofty range of mountains in Persia, province of Kurdistan, bounding the plain of Erzerum to the south-east. These mountains abound with springs, and give rise to numerous rivers; and they form the dividing ridge between the streams that flow into the Black Sea and those which flow east into the Euphrates.

KEBLA, an appellation given by the Mahommedans to that part of the world where the temple of Mecca is situated, towards which they are obliged to turn themselves when they pray.

KECSKEMET, a large town of the circle of Pest, in the Austrian kingdom of Hungary. It is in the middle of an extensive heath, between the Danube and the Theiss, and contains one reformed and four Catholic churches, three colleges, a Franciscan convent, a military academy, 3000 houses, and 24,862 inhabitants, who carry on considerable trade in internal productions. Long. 19. 37. 6. E. Lat. 46. 54. 29. N.

KEDAR, in *Ancient Geography*, a district in the desert of the Saracens (so called from Kedar the son of Ishmael, according to Jerome, who in another place says that it was uninhabitable), to the north of Arabia Felix.

KEDARNATH, a celebrated place of Hindu pilgrimage, in Northern Hindustan, situated in the mountains of Serinagur. Those who perform this difficult pilgrimage have to travel over the most steep and inaccessible roads, which, during half the year, are blocked up with snow. The place lies about fourteen or fifteen miles of direct distance west-north-west of Bhadrinath. The ceremonies observed here are nearly the same as at other places of Hindu ablution. The most peculiar of these is that of the widows shaving their heads, having previously bathed and purified themselves in the Ganges, which is here a narrow stream. Long. 79. 19. E. Lat. 32. N.

KEDES, in *Ancient Geography*, a city of refuge in the tribe of Naphtali, on the confines of Tyre and of Galilee. Jerome calls it a sacerdotal city, situated on a mountain, twenty miles from Tyre, near Paneas, and called *Cidissus*. It was taken by the king of Assyria.

KEDGE, a small anchor used to keep a ship steady whilst she rides in a harbour or river, particularly at the turn of the tide, when she might otherwise drive over her principal anchor, and entangle the stock or flukes with her slack cable, so as to loosen it from the ground. This is accordingly prevented by a kedge rope that hinders her from approaching it. The kedges are particularly useful in transporting a ship; that is, removing her from one part of the harbour to another, by means of ropes which are fastened to these anchors. They are generally furnished with an iron stock, which is easily displaced for the convenience of stowing them.

KEDGEREE, a town of Bengal, situated near the mouth of the Hooghly, where ships frequently stop either in entering or going out of the river. The river here expands to a breadth of nearly nine miles across. It is esteemed healthier than Diamond Harbour.

KEDRON, or CEDRON, in *Ancient Geography*, a town which, from the defeat and pursuit of the Syrians (1 Mac. xvi.), appears to have stood on the road leading from Upper India to Azotus. In this war it was burnt by the Jews.

KEDRON, or *Cedron*, in *Ancient Geography*. St John calls it a brook, but Josephus a deep valley between Jerusalem and Mount Olivet to the east. It was called *Kedron* from its blackness.

KEEL, the principal piece of timber in a ship, which is usually first laid on the blocks in building.

KEEL is also a name given to a low, flat-bottomed vessel, used in the river Tyne, to bring the coals down from Newcastle and the adjacent parts, in order to load the colliers for transportation.

Keel-Hauling was a punishment inflicted for various offences in the Dutch navy. It was performed by plunging the delinquent repeatedly under the ship's bottom on one side, and hoisting him up on the other, after having passed under the keel.

KEELAN ISLE, a small island, about twenty miles in circumference, lying off the western extremity of Ceram. The island is inhabited, and well planted with cocoa-nut and plantain trees. Long. 127. 55. E. Lat. 3. 15. S.

KEELSON, a piece of timber which may be properly defined the interior or counterpart of the keel, as it is laid upon the middle of the floor timbers, immediately over the keel, and, like it, composed of several pieces scarfed together.

KEEMA-KEDAN, a cluster of small islands, in the Eastern Seas, near the western coast of the island of Leyta. Long. 124. 36. E. Lat. 10. 30. N.

KEEN, or KAYNDUEM RIVER. This great river, which is supposed to have its source in the mountains which divide Assam from Ava, is the second river in the Burman empire. It enters Ava from the north-west, and falls into the Irrawaddy at Miondap, in lat. 21. 45. N. It is liable to floods during the rainy season; and, except during this season, its mouth is much obstructed by sand-banks covered with long grass and reeds. Being shallow, it is only navigable for flat-bottomed boats. Its banks are occupied by the rude and inoffensive tribes of the Kayns or Carianers. The adjacent country is said to be mountainous, and covered with wood. It has never been explored by Europeans.

KEEPER OF THE GREAT SEAL, is a lord by his office, and styled Lord Keeper of the Great Seal of Great Britain. He is always one of the privy council. All grants, charters, and commissions of the king under the great seal pass through the hands of the lord keeper.

Keeper of the Privy Seal is also a lord by his office, and through his hands all grants, pardons, and the like, pass before they come to the great seal; and even some things go through his hands which do not pass the great seal at all. This officer is also one of the privy council, yet was anciently called clerk of the privy seal.

KEEPING, in *Painting*, denotes the representation of objects in the same manner as they appear to the eye at different distances from it, for which the painter should have recourse to the rules of perspective.

KEFFING, an island, about forty-five miles in circumference, in the Eastern Seas, to the south-east of the island of Ceram, from which it is separated by a narrow strait. Long. 130. E. Lat. 3. 50. S.

KEFIL, a village of Irak Arabi, held in peculiar veneration both by Jews and Mahommedans as the tomb of the prophet Ezekiel, and hence a frequent resort of pilgrims. It is fourteen miles south of Hillah.

KEGWORTH, a parish in the county of Leicester, in the hundred of West Goscote, 114 miles from London. It stands on the river Trent, over which is Cavendish Bridge, built by the Duke of Devonshire, to whom a toll is paid. The inhabitants amounted in 1801 to 1360, in 1811 to 1550, in 1821 to 1607, and in 1831 to 1840.

KEHL, a town of the bailiwick of Kork, in the duchy of Baden. It is situated on the right bank of the Rhine, opposite to Strasburg, and during the revolutionary wars was celebrated for the strength of its fortress, which commanded the passage of the river, and stood on an island of the Rhine. The works have been neglected since 1815, and are now in ruins, though some of the more substantial buildings remain. There is a bridge connecting Kehl with Strasburg. The population has increased lately, and is said to exceed 2000.

KEIGHLEY, a market-town and parish in the west riding of the county of York. It is situated in a romantic spot in a valley, through which the river Aire runs, and near the canal which connects the two great trading towns of Leeds and Liverpool. It has thus an easy intercourse with every part of the kingdom, and a great increase of its trade and population has hence arisen. There are in it several large establishments for making woollen, linen, and cotton goods. The church is a large and handsome building, and it has several chapels for the different descriptions of dissenters. There is a well-supplied market on Wednesday. The population amounted in 1801 to 5745, in 1811 to 6864, in 1821 to 9223, and in 1831 to 11,176.

KEILL, John, a celebrated astronomer and mathematician, was born at Edinburgh in 1671, and studied in the university of that city. In 1694 he went to Oxford, where, being admitted of Baliol College, he began to read lectures according to the Newtonian system, in his private chamber in that college. He is said to have been the first who taught Sir Isaac Newton's principles by the experiments on which they are founded; and this, it seems, he did by an apparatus of instruments of his own providing, by which means he acquired a great reputation in the university. The first specimen he gave to the public of his skill in mathematical and philosophical knowledge, was his Examination of Burnet's Theory of the Earth, with remarks on Mr Whiston's Theory; and these theories being defended by their respective inventors, Mr Keill published an Examination of the Reflections on the Theory of the Earth, together with a Defence of the Remarks on Mr Whiston's New Theory. In 1701, he published his celebrated treatise, entitled *Introductio ad veram Physicam*, which only contains fourteen lectures; but in the following editions he added two more. This work has been translated into English, under the title of an Introduction to Natural Philosophy. Afterwards, being made fellow of the Royal Society, he published, in the Philosophical Transactions, a paper on the laws of attraction; and, being offended at a passage in the *Acta Eruditorum* of Leipsic, warmly vindicated against Leibnitz, Sir Isaac Newton's right to the honour of priority in the invention of the method of Fluxions. In 1709 he went to New England as treasurer of the Palatines. About the year 1711, several objections being urged against Sir Isaac Newton's philosophy, in support of Descartes's notions of a *plenum*, Mr Keill published a paper in the Philosophical Transactions, on the rarity of matter, and the tenuity of its composition. But whilst he was engaged in this dispute, Queen Anne appointed him her decipherer; and he continued in that situation under King George I. until the year 1716. He had also the degree of doctor of physic conferred upon him by the university of Oxford in 1713. Besides the works already mentioned, Dr Keill published *Introductio ad veram Astronomiam*, which was translated into English by the author himself; and an edition of Commandinus's Euclid, with additions of his own.

Keill, *James*, an eminent physician, and brother of the preceding, was born in Scotland about the year 1673; and having travelled abroad, read lectures on anatomy with great applause in the Universities of Oxford and Cambridge, by the latter of which he had the degree of doctor of physic conferred upon him. In 1700 he settled at Northampton, where he had considerable practice as a physician; and died there of a cancer in the mouth in 1719. He published, 1. An English translation of Lemery's Chemistry; 2. An account of Animal Secretion, the quantity of Blood in the human Body, and Muscular Motion; 3. A Treatise on Anatomy; and, 4. Several pieces in the Philosophical Transactions.

KEITH, James-Francis Edward, field-marshal in the Prussian service, was the younger son of William Keith, earl marischal of Scotland, and was born in 1696. He was designed by his friends for the law; but his inclination led him to the profession of arms, and the first occasion of drawing his sword was at the age of eighteen years, when the rebellion broke out in Scotland. Through the instigation of his mother he joined James's party, and was wounded at the battle of Sheriffmuir, but afterwards made his escape to France. There he applied himself to military studies; and having proceeded to Madrid, he, by the interest of the Duke of Leiria, obtained a commission in the Irish brigade, then commanded by the Duke of Ormond. He afterwards attended the Duke of Leiria when he went as ambassador to Muscovy; and, being by him recommended to the czarina, was promoted to the rank of lieutenant-general, and invested with the order of the black eagle. He distinguished himself by his valour and conduct in the Russian service, and had no inconsiderable share in the revolution which raised Elizabeth, the daughter of Peter the Great, to the throne. He also served in several embassies; but finding the honours of that country only a splendid species of slavery, he left the Muscovite court, and entered the Prussian service. The king of Prussia made him field-marshal of the Prussian armies, and governor of Berlin; and so far distinguished him by his confidence, as to travel in disguise with him over a great part of Germany, Poland, and Hungary. In business, Frederick made him his chief counsellor; in his diversions, his chief companion. The king was much pleased with an amusement which the marshal invented, in imitation of the game of chess. The latter ordered several thousand small statues of men in armour to be cast by a founder; these he would set opposite to each other, and range them in battle array, in the same manner as if he had been drawing up an army; he would then bring out a party from the wings or centre, and show the comparative advantage or disadvantage resulting from the different draughts which he made. In this manner the king and the marshal often amused themselves, and at the same time improved their military knowledge. This brave and experienced general, after rendering many important services in the wars of that illustrious monarch, was killed in the unfortunate affair of Hochkirchen, in the year 1758.

The family of Keith was amongst the most ancient in Europe. In 1010, the Scotch having gained a complete victory over the Danes at Camus Town in Angus, King Malcolm II., as a reward for the signal bravery of a certain young nobleman, who pursued and killed Camus, the Danish general, bestowed on him several lands, particularly the barony of Keith in East Lothian, from which his posterity assumed their surname. The king also appointed him hereditary great marischal of Scotland, which high office continued in his family till the year 1715, when the last earl having engaged in the rebellion, forfeited his estate and honours; and thus ended the family of Marischal, after serving their country in a distinguished capacity for above seven hundred years.

KEJ, a town of Persia, and the present capital of the province of Mekran. Being situated on the high road from Candahar, Kelat, Shikrapoor, Khozdar, Bayla, &c. to the sea-port towns of Guatter and Chobar, it is a town of considerable importance, and an emporium of trade. The town encircles a fort, which is built on a high precipice, under which a river runs; and, from its natural strength, it is considered as impregnable by the natives. The governor or naib of Kej holds the city and district under the nominal authority of Mahmood Khan of Kelat, though he does not acknowledge his authority by the payment of tribute. The revenues are trifling, and the governor, who formerly supported 4000 or 5000 men, has only a small number of Arabs in his pay. The country in the immediate vicinity is described as a flat and arid tract of waste land, extending northward as far as the sea-coast, and in some spots producing great quantities of dates. The flat is in some places intersected by ranges of hills and bare rocky mountains running north and south, but not advancing to the sea-shore.

KELAT, a city of Asia, the capital of Beloochistan, and thence called Kelat, or the city. Its situation is elevated on the western side of a well-cultivated plain or valley, about eight miles in length and two or three in breadth, the greater part of which is laid out in gardens and other enclosures. The town is built in the form of an oblong square; three sides of it are encompassed by a mud wall eighteen or twenty feet high, flanked at intervals of 250 paces by bastions, which, as well as the wall itself, are pierced with numberless loop-holes for matchlock men; but no cannon are now mounted. The defence of the fourth side of the city is formed by the western face of the hill on which it is built, being cut away perpendicularly. There are within the walls 2500 houses, without the wall 1250. They are built of half-burnt brick or wooden frames, and plastered over with mud or mortar; the streets are broader than those of native towns, and have mostly a raised pathway on either side for foot passengers, and an uncovered kennel in the centre, which is a recipient for all filth, and dirt, and stagnant water. The upper stories of the houses also stretching across the streets, render the part beneath them gloomy and damp. The palace of the chief of Kelat stands on the summit of the hill on which the city is built. Viewed from the outside, it appears an irregular heap of common mud buildings, with flat roofs, forming terraces, protected by low parapet walls pierced with loop-holes. The quarter on which the khan's residence is erected has been enclosed by a mud wall with bastions. The bazar of Kelat is extensive, and well furnished with every kind of goods, and with provisions of all sorts, which can be procured at a moderate rate. The town is also supplied with delicious water, from a spring in the face of a hill on the opposite side of the plain, whence it meanders through the centre of it. The inhabitants of Kelat may be divided into four classes, namely, the Beloches or Brahooes, Hindus, Afghans, and Dehwars. The latter are the principal merchants of the place, and are therefore encouraged by the chief. Long. 67. 57. E. Lat. 29. 6. N.

Kelat, or the fortress, is a singular valley in the province of Khorassan, in Persia, which extends, in a direction nearly east and west, from fifty to sixty miles in length, and from twelve to fifteen in breadth, situated amongst the hills that divide the plain of Mushed from the desert. It is surrounded by mountains so steep and difficult by nature as to be almost impassable, and they have been rendered completely so by art. The rocks, says Fraser, are scarped in the outside, presenting a mural appearance, so that there is no possibility of sealing them; and beyond these is a lesser range, with a hollow between, which the natives call the ditch. Not less care has been taken in the inside to increase every natural difficulty, so as to render a descent into or an escape from the valley equally impracticable. There are two openings in this valley, one at the western and one at the eastern extremity. These openings, which are both narrow and intricate, are called the *gates* of the fortress, and have been built up and fortified in such a manner that it is impossible to force an entrance. On these fortified gateways there are towers where watchmen are continually posted to give warning of all who approach, and none are admitted except those who have passed from the end of the valley. In this valley there is a great deal of cultivation, and its population amounts to 2000 families. It was in this stronghold that Nadir Shah intended to deposit his vast treasure. Futeh Allee Khan was placed in command of the fortress by Allee Shah, after the death of Nadir, and was killed in a brawl which subsequently took place. His son succeeded in putting the murderer to death, and he has ever since retained possession of the fortress. He is an independent chieftain, possessed of 1000 horse and 2000 foot, and can considerably increase the number by arming his villagers. As he is besides on good terms with the Toorkomans of the desert, he can always command a large force of their cavalry.

Kelat, a town and strong fortress of Afghanistan, in the province of Candahar. It was taken by the Emperor Baber in the year 1506; but, upon the decline of the Mogul empire, it fell again into the hands of the Afghans. Mr Foster, who passed it in 1783, describes it as a fort situated on an eminence, surrounded by a desert country. It is sixty miles east-north-east of the city of Candahar.

KELENDRI, a seaport of Caramania, in Asiatic Turkey, the ancient Celendris, the ruins of which lie scattered in heaps at the foot of the mountains, and along a small bay. It is twenty-five miles south-west of Selefkeh.

KELIKDONI, or Erminak, a river of Asia Minor, the ancient Calycadnus, which falls into the Mediterranean near Selefkeh. It is nowhere fordable, but travellers are accustomed to swim across on bladders.

KELLAMUNGULLUM, a town of Hindustan, in the ceded districts of Mysore, annexed to the Barramahal. It contains about 300 houses, and is defended by a small fort, with two reservoirs. A considerable quantity of opium is produced in the neighbourhood. It was at this place that, in 1799, the grand army assembled which overthrew the power of Tippoo Sultan. Long. 78. 5. E. Lat. 12. 35. N.

KELLY, Hugh, an author of some repute, was born on the banks of the lake of Killarney, in Ireland, in 1739. His father, a gentleman of good family, having reduced his fortune by a series of unforeseen reverses, was obliged to repair to Dublin that he might endeavour to support himself by his personal industry. A tolerable school education was all he could afford to give his son, who was bound apprentice to a stay-maker, and served the whole of his time with diligence and fidelity. At the expiration of his indentures he set out for London to procure a livelihood by his business, and there encountered all the difficulties a poor and friendless person might be expected to meet with on his first arrival in town. Happening, however, to become acquainted with an attorney, he was employed by him in copying and transcribing. He prosecuted this occupation with so much assiduity, that he is said to have earned about three guineas a week, an income which, compared to his former gains, might be deemed affluent. Tired, however, of this drudgery, he soon afterwards (about 1762) commenced author, and was intrusted with the management of the Lady's Museum, the Court Magazine, the

Public Ledger, the Royal Chronicle, Owen's Weekly Post, and some other periodical publications, in which he wrote many original essays and pieces of poetry, which extended his reputation, and procured the means of subsistence for himself, his wife, and a growing family. For several years after this period, he continued writing upon a variety of subjects, as the accidents of the times chanced to call for the assistance of his pen; and he employed himself in composing many pamphlets on the important questions then agitated, the greater part of which are now buried in oblivion. Amongst these productions, was a Vindication of Mr Pitt's Administration, which Lord Chesterfield makes honourable mention of in the second volume of his Letters. In 1767, the Babbler appeared in two pocket volumes, which had at first been inserted in Owen's Weekly Chronicle, in single papers; as did also the Memoirs of a Magdalene, under the title of Louisa Mildmay. About 1767, he was tempted, by the success of Churchill's Rosciad, to write some strictures on the performers of both theatres, in two pamphlets, entitled Thespis, which gave great offence to some of the principal persons at each house. The talents for satire which he displayed in this work recommended him to the notice of Mr Garrick, who, in the next year, caused his first play of False Delicacy to be acted at Drury Lane. It was received with great applause; and from this time he continued to write for the stage with profit and success, until the last period of his life. As his reputation increased, he began to turn his thoughts to some mode of supporting his family less precarious than by writing, and for that purpose entered himself a member of the Middle Temple. After the regular steps had been taken, he was called to the bar in 1774, and his proficiency in the study of the law afforded promising hopes that he might make a distinguished figure in that profession. But his sedentary course of life had by this time injured his health, and subjected him to much affliction. Early in 1777, an abscess formed in his side, which, after a few days' illness, put a period to his life. He was the author of six plays besides that above mentioned.

KELP, a term which is used in Britain to signify the alkaline substance obtained by burning sea-weed, and which is chiefly employed in the manufacture of green glass. Different species of sea-weed, belonging to the genus *fucus*, and order *algæ*, are cultivated for this purpose. These plants are thrown on the rocks and shores in great abundance, and in the summer months are raked together and dried as hay in the sun and wind, and afterwards burned to the ashes called *kelp*. The process of making it is this: The rocks which are dry at low water are the beds of great quantities of sea-weed, which is cut, carried to the beach, and dried. A hollow is dug in the ground three or four feet wide; round its margin are laid a row of stones, on which the sea-weed is placed and set on fire within; and quantities of this fuel being continually heaped upon the circle, there is in the centre a perpetual flame, from which a liquid like melted metal drops into the hollow beneath. When it is full, as it commonly is ere the close of the day, all heterogeneous matter being removed, the kelp is wrought with iron rakes, and brought to an uniform consistence in the state of fusion. When cool, it consolidates into a heavy, dark-coloured, alkaline substance, which undergoes in the glass-house a second vitrification, and, when pure, assumes a perfect transparency.

KELPOORY, a town and small district of Hindustan, in the province of Delhi. The district is situated about the 29th degree of north latitude, and is bounded on the north by the mountains of Kemaon. The soil is fertile, with the exception of a considerable portion that is overgrown with extensive forests. It was ceded to the Company in 1801 by the nabob of Oude, and is now included in the collectorship of Bareilly. The town is forty-eight miles north-north-east from Bareilly. Long. 79. 39. E. Lat. 28. 59. N.

KELSO, a town of Roxburghshire, is delightfully situated, partly on a plain, and partly on a declivity on the north bank of the Tweed, opposite to its junction with the Teviot, in long. 1. 20. W. and in lat. 55. 38. N. When the town was first built cannot now be ascertained; but, from various ancient records, in which the name is written Calchow, Calco, and Kellsowe, it appears to have been of considerable antiquity and importance.

During the border conflicts, Kelso was frequently exposed to the ravages of war, and was thrice burned down by the English. It was also destroyed by an accidental fire in the year 1686, and at different subsequent periods of its history.

The Duke of Roxburghe, whose magnificent mansion is situated about a mile to the west, and commands one of the most delightful prospects, is superior of the town, and lord of the manor. Kelso was first incorporated into a burgh of barony in the year 1605, under a charter granted by King James I. to Sir Robert Ker of Cessford; and it is governed by a baron bailie and fifteen stentmasters, who compose the town council, eight of whom are nominated by the bailie, and seven by the different incorporated bodies.

The town, which has of late been greatly improved by the erection of many elegant houses, consists of four principal streets, branching at right angles from a spacious square or market-place, extending in length 300 feet, and in breadth 200. On the east side stands the town-hall, a chaste modern structure, two stories in height. But the most attractive object to the eye of the stranger is the ruins of the venerable abbey, which present one of the finest specimens of Saxon or early Norman architecture that this country can produce. It is built in the form of the Latin cross, with the principal entrance to the west, of which only a segment remains. Some years ago, the modern part of the building, which was used from the time of the reformation till 1773 as the parish church, was taken down, and the interior of the structure, disclosing two lofty pointed arches, exposed to view. The abbey was founded on the 3d of May 1128, by David I., by whom it was richly endowed; but it was destroyed during an incursion of the English in the year 1545, under the Earl of Hertford. Contiguous to the abbey is the bridge over the Tweed, founded in the year 1800. It is a handsome and elegant structure, consisting of five bold elliptical arches of nearly equal span.

Kelso being in the centre of a rich and fertile agricultural district, has, besides a weekly market on Fridays, two fairs in the year, as well as different other markets at fixed seasons for the sale of stock, horses, and the like. Notwithstanding many facilities for carrying on manufactures, Kelso is without any. There are, however, a distillery and a brewery, four public banks, and a gas-work; and it is in contemplation to carry into execution a rail-road from Berwick, by Kelso, to Hawick, for which an act of parliament was obtained some years ago. There are six places of worship in the parish, including an established church and an Episcoplian chapel. There are two parochial schools, one for Latin, and the other for reading, writing, &c., besides several private seminaries of education, a subscription school for the poor, and another for the instruction of girls, founded and principally supported by the Duchess of Roxburghe. Kelso possesses a public dispensary, three public subscription libraries, two reading rooms, a debating society, and another called the Tweedside Physical and Antiquarian Society. In 1821, the population amounted to 4000, and in 1831 to 4700.

KELVEDON, a town of the hundred of Whitham, in the county of Essex, on the great road to Colchester and Ipswich, forty miles from London. It stands on the river Pant, in a very fertile district, and consists chiefly of one long and well-built street, with several good inns. The population amounted in 1801 to 994, in 1811 to 1186, in 1821 to 1328, and in 1831 to 1463.

KEMAON, or KUMAON, a district of Northern Hindustan, which was formerly a Hindu principality, conterminous with that of Duti on the east, the boundary line being the Cali River. On the west it was separated from Gurwal by the Ramgunga, and extended a considerable way into the plains of Bareilly. The modern district of Kemaon, as it has been regulated by the British since its conquest in 1815, comprehends the whole tract of country between the Ganges and the Cali, from the plains to the highest pinnacle of the Himalaya, which space includes a large portion of the Gurwal province south-east of Alcananda, whilst the Cali River on the east forms a natural and well-defined boundary towards Nepaul. The other geographical divisions are Kemaon proper, Painkhandi, and Bhutant, within the limits of which last is the pass of Niti, supposed to have been the earliest and most frequented route into Chinese Tartary. It includes an area of 7000 square miles.

Kemaon is situated amongst the lower ranges of the Himalaya Mountains. It is separated from the lower districts of Bareilly and Morabad by a thick forest of nearly two days' journey, which surrounds the whole and skirts the margin of the mountains. The soil is marshy, and the atmosphere, during two thirds of the year, is more pestilential than that of the Sunderbunds; it is, says Heber,[1] " a literal belt of death, which even the natives tremble to go near, and which, during the rains more especially, the monkies are forced to abandon. After the middle of November this is dry, practicable, and safe." Kemaon proper is separated on the north-east from the province of Gurwal by a range of mountains, which, in point of ruggedness, presents a contrast to the hills of Kemaon. These latter appear to rise in a regular gentle acclivity from their bases; and the soil is fertile, consisting of rich earth, which gives nourishment to fine verdure and extensive forests. The hills are also intersected by rather spacious valleys, rendered fertile by tillage; and the cultivation is more extended, and carried farther up the hills, than in Gurwal with a denser population. In these valleys, rice is produced in abundance, and the cultivator is thus in a manner rendered independent of the seasons, as the numerous mountain streams, descending in every direction, enable him to irrigate all the lower lands. The higher lands produce wheat, barley, and various small grains, which being raised in a redundant quantity, form an article of traffic with Bhutant. There are several passes into Kemaon from the districts of Bareilly and Morabad, but those leading through Cossipoor and Roderpoor are considered as the best, and are most frequented. The first leads by Chilkeah, where an annual fair is held, to which the hill people resort in great numbers. Similar meetings also occur at Bhagesur, on the banks of the Cali, each continuing ten days, and are frequented by merchants from Bhote and the low countries. Chilkeah is one of the principal marts of trade in Kemaon, and through that country into Thibet and Tartary. The article which meets with the readiest sale is cloth with distinct colours on each side. European articles, of a coarse quality, are also in demand, such as knives, razors, wine-glasses, tumblers, spying and looking glasses, spectacles, and cheap enamelled watches; and Bishop Heber also saw exposed to sale English cloths, and eastern shawls of good appearance, with many other serviceable and valuable commodities. The greatest staple that is exported from this southern frontier has always been timber, found in the immense forests already mentioned, which skirt the border. Here the saul forests are of great extent, and produce some of the best timber of that species in India. Owing to the difficulty of access, it is necessary to convert the trees into planks on the spot, that they may be the more easily transported to the populous parts of the country. In some parts they have to be carried down a perpendicular height of 500 feet. The fir-tree grows to an immense size, and it is much stronger than the firs of Europe, and as heavy as teak, the grain strong and full of turpentine. Some of the trees have from sixty to seventy feet clear of branches, and the spans are from twenty to twenty-three inches in diameter. Rosin, turpentine, doedwar, oil, and hemp of an excellent quality, are to be found among the Kemaon Hills. The bamboo, though small, grows remarkably tough, and seems to gain consistency and soundness from a certain degree of frost. The same is said to be the case with the plantains. The tea-plant grows wild all through Kemaon, but cannot be made use of, from an emetic quality which it possesses. The upper mountains produce copper, lead, iron, and the Panar River gold, but there is no mine of consequence. The northern parts are cold, and yield pasture for numerous flocks of sheep; and in summer a considerable intercourse is carried on with the country subject to China.

The towns and villages of Kemaon, when viewed from a distance, present a neat appearance. But a nearer approach does not confirm these favourable prepossessions. They are generally surrounded by dirt and filth; though Bishop Heber mentions, that the town of Almorah is very neat, with a natural pavement of slaty rock, which is kept beautifully clean. He mentions, however, of the peasantry, namely, the Khasyas, that, near Almorah, though they are honest, peaceable, and cheerful, they are dirty to a degree which he never saw amongst the Hindus, and extremely averse to any improvement, using their women ill, and employing them in the most laborious tasks. These people are rigid Hindus. The houses are generally constructed of large masses of stone, roofed with slate, and of two stories in height, the lower story being allotted to cattle. Their poverty is extreme, their food consisting of coarse cakes made from the grain of a kind of holcus, in which the flour, bran, and husk, are mixed together, and baked, or rather scorched, on the fire. In other parts, however, as he advanced farther among the hills, Bishop Heber saw tolerably neat and comfortable cottages, the people better fed and clothed than most of the Khasyas. Polygamy is common among the lower classes.

Wild animals abound in the mountains and forests of this country. The tiger is found quite up to the glaciers, of size and ferocity undiminished. There are also lynxes, and bears are common and mischievous throughout the province. Though they do not, except when pressed by hunger, eat flesh, preferring roots, berries, and honey, yet, as if out of capricious cruelty, they often worry and destroy passengers. The chamois is not uncommon in the snowy mountains, but scarce elsewhere; and the hares are much finer and larger than those in Hindustan, and not much inferior to those of Europe. The musk-deer is also found in the highest and coldest parts of the province, and the neighbouring countries of Thibet and Tartary. It cannot, says Heber, even bear the heat at Almorah. In like manner, the yak or mountain ox of Tartary droops as soon as it leaves the neighbourhood of the ice. The shawl-goat will live, but its wool degenerates. On the other hand,

[1] Vol. ii. p. 143.

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English dogs, impaired by the climate of the plains, improve in strength, size, and sagacity, amongst the mountains; and it is remarkable that, in a winter or two, they acquire the same fine short shawl-wool, mixed with their own hair, which distinguishes the indigenous animal of the country. The same is in some degree the case with horses. Flying squirrels are also common amongst the colder and higher parts of these woods. Some of the marmots, of the alpine kind, also abound in the neighbourhood of the snow. A singular species of wild dog is mentioned as a native of these hills. In form and fur these animals resemble a fox, but they are much larger. They hunt in packs, give tongue like dogs, and possess a very fine scent. They make great havock of the game amongst the hills, and even attack and destroy the tiger, overpowering him by their numbers. Of birds, the condor is to be found of a remarkable strength and size. Eagles are numerous, and very large and formidable; and these birds do much injury to the shepherds and goatherds, and sometimes carry away the poor naked children of the peasants. Their nests being in the remote glaciers, and among inaccessible crags, there is no possibility of destroying these dangerous animals. There are larks in Kemaon, not very different from the English, as well as quails, partridges, pheasants, thrushes, &c. A little bird resembling the robin, and the goldfinch, are found at the foot of the snowy mountains.[1]

This country, though, from its elevation, the climate is colder than in Hindustan, with ice and snow in winter, is remarkably unhealthy, from a certain malaria which prevails in all the lower valleys, especially during and after the rainy season, and which gives rise to ague, intermittents, and fevers which assume the appearance of typhus, and under which the powers of life decline more rapidly, though often not more surely, than under continued fits of the ague. Several of the inhabitants seen by Bishop Heber in this devoted region, he describes as singularly wretched; the fever and the ague destroying all their energy, and preventing them from adopting the simple means of dry and well-raised dwellings, and sufficient clothing, to support life and health. "They are," says the intelligent traveller already quoted, "a very ugly and miserable race of human beings, with large heads, and particularly prominent ears, flat noses, tumid bellies, slender limbs, and sallow complexions, and have scarcely any garments but a blanket of black wool, though most of them have matchlocks, swords, and shields." The chief region of insalubrity is at the foot of the lowest hills, where a long, black, and level line of forest extends, though the mountainous country is also more or less unhealthy in all the low valleys. This insalubrity is said to be increasing. The industry of the inhabitants was at one time reclaiming the forest, and the cowmen and woodmen were pushing their incursions farther every year; and the plains, now desolate, being shunned as the abodes of disease, were once populous. But the country was ruined by the invasion of Meer Khan in 1805, and it has never recovered from the devastation to which it was exposed from his licentious soldiery. So terrified are the natives to approach it, that no witnesses can be procured, at certain seasons of the year, to attend the circuit court; and two of them, rather than go to Chilkeah, forfeited a small pension which was due to them.

This country was acquired by the British government in 1815, when its limits were extended to the westward by the annexation of a portion of Gurwal, east of the Alcananda and the Ganges. Prior to this, it was ruled by military chiefs, who owned a nominal allegiance to Nepaul, though they were nearly independent within their own territories. They were extremely tyrannical, and not only divided the lands amongst themselves, without regard to the rights of the ancient proprietors, but, on any arrears of rent, sold the wives and children of the peasants as slaves, to an amount almost incredible, whilst they quelled every murmur among the people by the most barbarous severity. The court of Nepaul issued repeated edicts against the practice, but without effect, since most of the young persons who were of a marketable age were sold into slavery when the British, to the great joy of the inhabitants, who gave them every possible aid, acquired possession of the country. Since this period uninterrupted tranquillity has prevailed, which may be partly ascribed to the peaceable and orderly habits of the people, and to the general popularity of the British government. The revenue of the country has been fixed at 85,746 rupees for Kemaon proper, and at 37,614 for the annexed districts of Gurwal; and, as a proof that the assessment is moderate, it has been punctually realized, and has even been paid in many instances in advance.

Almorah is the chief town. The population of Kemaon proper is estimated at 300,000; that of Gurwal, east of Alcananda, is yet more considerable; and the people generally are in a high state of civilization. (F.)

Kemble.

KEMBLE, John Philip, one of the greatest tragedians that England ever produced, was born on the 1st of February 1757, at Prescot, in Lancashire. Mr Roger Kemble, his father, though only the manager of a provincial company of actors, was of ancient and respectable family; and, sensible of the disadvantages attending his own profession, sent his son to receive his education at a Roman Catholic seminary, for the purpose, it is believed, of qualifying him to take orders in the Catholic church. He was also a student for two or three years at the College of Douay; but the strength of natural bias prevailed, and he became an actor in 1776. After performing in York, Liverpool, Manchester, Edinburgh, Dublin, and other places, and gradually acquiring reputation, he made his first appearance before a London audience on the 30th of September 1783, in the character of Hamlet. He was received by the public generally with great applause, although, as always happens in such cases, a party lagged behind, preferring and paying greater homage to a favourite idol of longer standing. He rapidly attained an acknowledged pre-eminence in the tragic scene, and took that decided lead which he ever afterwards maintained. He subsequently undertook the management of Drury Lane Theatre, which he conducted, with only a slight interruption, till 1801; and during that period the drama was indebted to him for various and considerable improvements, particularly in introducing appropriate costume. In 1794, he brought out a musical piece of his own, entitled *Lodoiska*, which was very successful at the time, and is still occasionally performed. He likewise revived old pieces of merit, and brought forward many new productions, some of which were of considerable merit, altered by himself. In 1802, he visited the Continent; and on his return to London, purchased a sixth share of Covent Garden Theatre, and became manager of that establishment. His career in this place was brilliantly successful, but partially suspended in consequence of the total destruction of the theatre by fire in 1809. A new edifice, however, was speedily reared, and opened with an increase of entrance-money, which, along with certain arrangements regarding the private boxes, created a series of disturbances, known by the name of O. P. riots, which lasted for sixty-six nights, and in which the public finally

[1] Heber, *Narrative of a Journey through the Upper Provinces of India*, vol. ii. p. 218, 219.

Kemble. carried their point. Kemble stood the storm with firmness; but he was subjected to much insolence, without having the power of retaliation within his reach. In 1812 he retired for two years, conceiving he had done his part, and being desirous of repose. His return to the stage was hailed with the utmost enthusiasm. He rose to the summit of popularity, and was acknowledged, without dispute, as the first actor in Britain, probably in the world. His health, however, began to give way; and he formed the resolution of taking farewell of the stage, which he did on the 23d of July 1817, after performing, with unabated power, his great character of Coriolanus. The "Valedictory Stanzas" addressed to him at a public meeting held in that month, do equal honour to the actor, and the poet Mr Campbell; and Sir Walter Scott composed the "Farewell Address" which he delivered on taking leave of the Edinburgh stage in the month of March preceding. He retired to the Continent, and fixed his residence at Lausanne, where he died on the 26th of February 1823.

In judging of the talents of Mr Kemble, we must regard him in the threefold character of actor, manager, and improver of dramatic representation. In reference to the first, tragedy, and that of the most stately and majestic character, was the line in which he excelled. His person was on a scale suited to the stage, being tall and stately; his countenance, in nobleness of expression, resembled the finest models of the antique; and his movements and demeanour, at once majestic and graceful, corresponded to the heroic cast of his form and features. What others assumed, seemed in him to be inherent. He looked an abstraction of the characteristics of tragedy, and trode the stage with solemn and majestic step, as if he were there "native, and to the manner born." His style was his own, and seemed to grow out of the peculiar qualities of his person and his intellect. It was that in which taste and judgment qualify and soften spontaneous conception and feeling with profound consideration, measured dignity, and learned precision. Talking of him generally, his deportment was solemn, his movements slow, his utterance deliberate, and always finely articulated, and his bearing and expression of countenance contemplative. His voice was distinct and impressive; but an early tendency to asthma rendered it necessary for him to husband his efforts in the more level parts, reserving them for those bursts of passion to which he gave such sublime effect. His acting was the result of long and laborious study, assisted by learning; he was a profound master in his art, and metaphysically curious in expressing each line of his part with the accent and manner exactly appropriate. Every word of a sentence had its peculiar emphasis; and this attention to minute details led him sometimes to suspend the action so long as to injure the effect, which, to be perfectly grand, should be instant, and not anticipated by any "note of preparation." A sacrifice of energy of action to grace has likewise been reckoned amongst the faults ascribed to this great actor; but this was more than compensated by the correctness of his conception of character, the precision of his taste, the patience of his investigation, which allowed of no point passing unconsidered, and that moral firmness which enabled him to maintain his own views regarding readings, when he believed himself in the right, against all opposition. Although some detracted from his merits on account of his peculiarities, all concurred in regarding him as a highly-gifted actor; and the impression which he made in characters more immediately adapted to his style of excellence, such as Cato, Coriolanus, Penruddock, Brutus, Macbeth, Hamlet, John, Jaques, and many others, will last as long as any mere recollection connected with the drama can last. As a manager he was gentlemanly, accurate, and regular; but somewhat strict. Reformation was carried by him into almost every department of the drama, and his innovations were calculated to confer permanent benefit on the art. Before his time there was no such thing as regular costume, and anachronisms of dress of the most ludicrous description were constantly exhibited. These Kemble reformed, by diligently consulting illuminated manuscripts, ancient pictures, and other contemporary authorities. Scenic decoration he also carried to a high degree of perfection, thereby adding to the splendour and illusion of the drama. In early life he published a volume of *Fugitive Pieces;* but all the copies of this production he afterwards carefully destroyed. His life (in 2 vols. 8vo, 1825) has been written by Mr James Boaden, a person whose power of doing justice to the subject of his biography appears to be extremely disproportionate to the admiration with which the great founder of the classic school of acting had inspired him. (R. R. R.)

Kempe ‖ Ken.

KEMPEN, a town of Prussia, the capital of the circle of the same name, in the province of Cleeves-Juliers. It contains 520 houses, with 3120 inhabitants, who carry on manufactures of linen and tapes. It is also the birth-place of the celebrated divine, Thomas à Kempis.

KEMPIS, Thomas a, a pious and learned regular canon, was born at the village of Kemp, or Kempen, in the diocese of Cologne, in 1380, and took his name from that village. He performed his studies at Deventer, in the community of poor scholars established by Gerard Groot; and there made great progress in the sciences. In 1399 he entered the monastery of the regular canons of Mount St Agnes, near Swol, of which his brother was prior. Thomas à Kempis there distinguished himself by his eminent piety, his respect for his superiors, his charity to his brother canons, and his continual application to labour and prayer. He died in the year 1471, at the age of ninety. The best editions of his works, which consist of sermons, spiritual treatises, and lives of holy men, are those of Paris in 1649, and of Antwerp in 1607. The well-known book *De Imitatione Christi*, which has been translated into all the languages of the civilized world, though it has commonly been numbered amongst the works of Thomas à Kempis, is also found printed under the name of Gerson; and, on the credit of some manuscripts, it has been since ascribed to the abbot Gerson, of the order of St Benedict. This occasioned a violent dispute between the canons of St Augustin and the Benedictines.

KEMPTEN, a city of Bavaria, in the province of the Upper Danube. It is situated on the river Iller, which is navigable nearly to its site, and is surrounded by hills. It is the seats of the revenue and police boards of the circle, and of the local courts of justice, both for civil and criminal affairs. The trade is inconsiderable, but consists in small linen and woollen manufactures. It contains 850 houses, and 5640 inhabitants, chiefly Catholics. Long. 10. 13. 25. E. Lat. 47. 44. 10. N.

KEN, Thomas, a deprived bishop of Bath and Wells, descended from an ancient family established at Kenplace, Somersetshire, was born at Berkhamstead, Hertfordshire, in the month of July 1637. At the age of thirteen he was sent to Winchester School, where he remained some time, and thence removed to New College, Oxford, of which he became a probationer-fellow in 1657. He took his degrees regularly; pursued his studies closely for many years; and in 1666 became a fellow of Winchester College, soon after which he was appointed domestic chaplain to the Bishop, and obtained the rectory o. Brixton in the Isle of Wight. In 1674, he made a journey to Rome, and after his return took his degrees in divinity. Not long afterwards, having been appointed chaplain to the Princess of Orange, he went to Holland, where his piety and prudence gained him general esteem; but having offended the prince, afterwards William III., by obliging one of his favourites to espouse a young lady of the princess's train whom he had seduced by a promise of marriage, Ken returned to England, and was employed to attend Lord Dartmouth in quality of chaplain to Tangier. Having returned with this nobleman in 1684, he was immediately appointed chaplain to the king, and not long afterwards nominated, without solicitation, to the bishopric of Bath and Wells. He attended the king in his last illness, and did his utmost to awaken the royal conscience; speaking, says Burnet, "with great elevation of thought and expression, and like a man inspired." The sudden death of the king delayed his admission to the temporalities of the see of Wells; but, on the accession of King James, new instruments were prepared for that purpose, and Ken entered upon the exercise of his episcopal functions. In 1685, he published an exposition of the Church Catechism; and, the same year, he gave to the world Prayers for the use of the Bath. He took no part in the popish controversy which was then so warmly agitated, though, in his discourses from the pulpit, he frequently took occasion to notice and confute the errors of Popery; nor did he hesitate, when preaching in the chapel-royal, to set before the court the dangerous policy of its projected coalition with the sectaries. Some attempts were made to gain him over to the interest of the popish party; but these proved completely abortive; and when the declaration of indulgence was ordained to be read, in virtue of the dispensing power assumed by the king, Ken was one of the seven who openly opposed it, and who were in consequence sent to the Tower. But though he ventured to disobey the mandate of his sovereign for the sake of his religion, he refused to transfer his allegiance; and, accordingly, on the arrival of the Prince of Orange, he suffered himself to be deprived, and withdrew to Longleate, a seat of Lord Weymouth, in Wiltshire, where he composed many pious works, and amused himself with writing verses, which, however, have but little of the spirit of poetry in them. Eventually he had settled on him a pension of L.200 a year, which was punctually paid out of the treasury as long as he lived. Dr Ken, who had long been afflicted with colic pains, experienced, in 1710, a paralytic attack, which deprived him of the use of one side; and, after lingering for some time in a hopeless state, he expired at Longleate, upon the 19th March 1711. His works, consisting for the most part of devotional pieces, in verse as well as in prose, were published in 1721, in four volumes. (A.)

Ken, a small island in the Persian Gulf. It possessed at one time a flourishing commerce, and is still capable of supplying refreshments to vessels, being better planted than most of the islands. Its ancient name was Kataia. It has a low and rocky coast in some parts, and must be approached with caution in the night. Long. 53. 40. E. Lat. 26. 27. N.

KENANY, a small island of Hindustan, situated about thirteen miles south of Bombay, and two and a half from the mainland. In 1678 Sevajee, the Mahratta chief, took possession of it, and from this station he greatly annoyed the trade of Bombay. It has a small harbour for vessels drawing little water, on the eastern side. Long. 72. 56. E. Lat. 18. 42. N.

KENDAL, a market-town of the county of Westmoreland, in the ward of the same name, 260 miles from London. It is situated on the river Ken, in a pleasant valley, and, by inland navigation, comes into connection with the sea, and with the rivers Morrey, Dee, Ribble, Ouse, Trent, Severn, Humber, Thames, and Avon. There is much industry applied to manufactures, the principal of which are the inferior kinds of woollen cloths and stuffs. It is a corporate town, under a mayor, twelve aldermen, and twenty-four capital burgesses, but returns no members to parliament. There are guilds or companies for several branches of trade, which now scarcely exist. The church is a large Gothic building, and there are chapels for the various denominations of Protestant dissenters, and for Roman Catholics. It is one of those towns which have been much increased and improved of late years. The population amounted in 1801 to 6892, in 1811 to 7505, in 1821 to 8984, and in 1831 to 10,015.

KENILWORTH, a town of the county of Warwick, in the hundred of Knightlow, 100 miles from London. It is celebrated as the residence of the Earl of Leicester, the favourite of Elizabeth, and for the entertainments given in the castle, the ruins of which attest their former splendour. There is a market which is held on Wednesday. The inhabitants amounted in 1801 to 1968, in 1811 to 2279, in 1821 to 2577, and in 1831 to 3097.

KENNEL, a term used indifferently for a puddle, a water-course in the streets, a house for a pack of hounds, and the pack or cry of hounds themselves. See Hound and Hunting.

KENNERI, a collection of remarkable caverns excavated in the rocky hills of the island of Salsette, near to Bombay, one of which had been fitted up by the Portuguese as a church, and they consequently thought it their duty to deface all the most pagan-looking sculptures. The fine teak ribs for supporting the roof are almost gone, and the portico is not so elegant as that at Carli. On the sides are two gigantic erect figures, each twenty-five feet in height, with their hands close to their bodies, which resembled the figures of Buddha seen at Ceylon. On each side of the great cave are smaller ones, apparently unfinished. The origin of these singular excavations is lost in obscurity. There is not even the slightest gleam of tradition to guide the antiquarian in his researches into these curious memorials of Hindu or Buddha superstition; and in what age of the world, or by what people, they have been completed, is a question now likely to remain for ever unknown.

KENNET, White, a learned English writer, and Bishop of Peterborough in the eighteenth century, bred at St Edmund Hall, Oxford, where he soon distinguished himself by his vigorous application to his studies, and by his translations of several works into English, and other pieces which he published. In 1695 Kennet published his Parochial Antiquities. But a sermon preached by him on the 30th of January 1703, at Aldgate, exposed him to great clamour. It was printed under the title of *A compassionate Inquiry into the Causes of the Civil War.* In 1706 he published his Case of Impropriations, and two other tracts upon the same subject. In 1706 he brought forward the third volume of the Complete History o. England, the two former volumes having been compiled by Mr Hughes. In 1709, he published a Vindication o. the Church and Clergy of England from some reproaches rudely and unjustly cast upon them; and a true Answer to Dr Sacheverel's Sermon. When the great point in Dr Sacheverel's trial, namely, the change of the ministry, was gained, and strange proceedings took place upon it, an artful address by the bishop and clergy of London was to be prepared, and they who would not subscribe it were to be represented as enemies to the queen and the ministry. Dr Kennet fell under this imputation. He was exposed to great odium as a low churchman, on account of his conduct and writings. When he was Dean of Peterborough, an uncommon method was taken to expose him by Dr Walton, rector of the church of Whitechapel. In the altar-piece of that church, which was intended to represent Christ and his twelve apostles eating the passover and last supper, Judas the traitor was drawn sitting in an elbow chair, dressed in a black garment, with a great deal of the air and appearance of Dr Kennet. It was generally said that the original sketch was intended for a bishop under Dr Walton's displeasure; but the painter being apprehensive of an action of *scandalum magnatum*, leave was given to drop the bishop and paint the dean. As this gave general offence, however, the Bishop of London ordered the picture to be taken down. In 1713 he presented the Society for Propagating the Gospel with a great number of books suitable to their design; published his *Bibliothecæ Americanæ Primordia;* and founded an antiquarian and historical library at Peterborough. In 1715 he published a sermon entitled the Witchcraft of the present Rebellion, and afterwards several other pieces. In 1717 he was engaged in a dispute with Dr William Nicholson, bishop of Carlisle, relating to some alterations in a sermon by the Bishop of Bangor; and he disliked the proceedings of the convocation against that bishop. Upon the death of Dr Cumberland, bishop of Peterborough, he was promoted to that see, to which he was consecrated in the year 1718. He sat in it more than ten years, and died in 1728. He was an excellent philologist, a good preacher, and well versed in the history and antiquities of our nation.

Kennet, *Basil*, a learned English writer, brother of the preceding, was educated in Corpus Christi College, in the university of Oxford, where he became fellow. In 1706 he went as chaplain to the English factory at Leghorn, where he met with great opposition from the Papists, and was in danger from the inquisition. Kennet died in the year 1714. He published Lives of the Greek poets, Roman Antiquities, a volume of Sermons preached at Leghorn, and a translation into English of Puffendorf's Treatise of the Law of Nature and Nations. He was a man of most exemplary integrity, generosity, piety, and modesty.

KENNICOTT, Dr Benjamin, well known in the learned world for his elaborate edition of the Hebrew Bible and other valuable publications, was born at Totness, in Devonshire, in the year 1718. His father was the parish clerk of Totness, and once master of a charity school in that town. At an early age young Kennicott succeeded to the same employment in the school, being recommended to it by his remarkable sobriety and premature knowledge. It was in this situation he wrote the verses on the recovery of the honourable Mrs Courtney from a dangerous illness, which recommended him to her notice, and that of many neighbouring gentlemen, who, with laudable generosity, opened a subscription to send him to Oxford. In judging of this performance, they may be supposed to have considered not so much its intrinsic merit, as the circumstances under which it was produced. For although it might justly claim praise as the fruit of youthful industry struggling with obscurity and indigence, yet as a poem it never rises above mediocrity, and generally sinks below it. But, in whatever light these verses may be considered, the publication of them was soon followed by such contributions as procured for the author the advantages of an academical education. In the year 1744 he entered himself at Wadham College: and it was not long before he distinguished himself in that particular branch of study in which he afterwards became so eminent. His two dissertations, on the Tree of Life, and the Oblations of Cain and Abel, came to a second edition as early as the year 1747, and procured him the singular honour of a bachelor's degree conferred upon him gratis by the university a year before the statutable time. The dissertations were gratefully dedicated to those benefactors whose liberality had opened his way to the university, or whose kindness had made it a scene not only of manly labour, but of honourable friendship. With such merit and such support, he proved a successful candidate for a fellowship of Exeter College; and soon after his admission into that society, he distinguished himself by the publication of several occasional sermons. In the year 1753 he laid the foundation of that stupendous monument of learned industry, at which the wise and the good will gaze with admiration, when the cavils of prejudice, and envy, and ingratitude, shall no longer be heard. This he did by publishing his first dissertation, on the state of the printed Hebrew text, in which he proposed to overthrow the then prevailing notion of its absolute integrity. The first blow, indeed, had been struck long before by Capellus, in his *Critica Sacra*, published after his death by his son, in 1650; a blow which Buxtorf, with all his abilities and dialectical skill, was unable to ward off. But Capellus having no opportunity of consulting manuscripts, though his arguments were supported by the authority of the Samaritan Pentateuch, and that of parallel passages and the ancient versions, could never absolutely prove his point. Indeed the general opinion was that the Hebrew manuscripts contained none, or at least very few and trifling variations from the printed text; and with respect to the Samaritan Pentateuch, the most opposite opinions were entertained. Those who held the Hebrew verity, of course condemned the Samaritan as corrupt in every place where it deviated from the Hebrew; and those who believed the Hebrew to be incorrect, did not think the Samaritan of sufficient authority to correct it. Besides, the Samaritan itself appeared to very great advantage; for as no Samaritan manuscripts were then known, the Pentateuch itself was rashly condemned for errors which ought rather to have been ascribed to the incorrectness of the editions. In this dissertation, therefore, Dr Kennicott proved that there were many Hebrew manuscripts extant, which, though they had hitherto been generally supposed to agree with one another, and with the Hebrew text, yet contained many and important various readings; and that from those various readings considerable authority was derived in support of the ancient versions. He announced the existence of six Samaritan manuscripts in Oxford alone, by which many errors in the printed Samaritan might be removed; and he attempted to prove, that even from the Samaritan, as it was already printed, many passages in the Hebrew might undoubtedly be corrected. This work, as might reasonably be expected, was examined with great severity both at home and abroad. In some foreign universities the belief of the Hebrew verity, on its being attacked by Capellus, had been insisted on as an article of faith. "Ista Capelli sententia adeo non approbata fuit fidei sociis, ut potius Helvetii theologi, et speciatim Genevenses, anno 1678, peculiari canone caverint, ne quis in ditione sua minister ecclesiæ recipiatur, nisi fateatur publice textum Hebræum, ut hodie est in exemplaribus Masoreticis, quoad consonantes et vocales, divinum et authenticum esse."[1] And at home this doctrine of the corrupt state of the Hebrew text was opposed by Comings and Bate, two Hutchinsonians, with as much violence as if the whole truth of revelation had been at stake.

The next three or four years of Dr Kennicott's life were principally employed in searching out and examining Hebrew manuscripts, though he found leisure not only to preach, but also to publish several occasional sermons. About this time Dr Kennicott became one of the king's preachers at Whitehall; and in the year 1759 we find

[1] Wolfii *Biblioth. Heb.* tom. ii. p. 27.

him vicar of Culham in Oxfordshire. In January 1760 he published his second dissertation on the state of the Hebrew text, in which, after vindicating the authority and antiquity of the Samaritan Pentateuch, he disarmed the advocates for the Hebrew verity of one of their most specious arguments. They had observed that, the Chaldaic Paraphrase having been made from Hebrew manuscripts near the time of Christ, its general coincidence with the present Hebrew text must evince the agreement of the latter with the manuscripts from which the paraphrase was taken. Dr Kennicott demonstrated the fallacy of this reasoning, by showing that the Chaldaic Paraphrase had been frequently corrupted, in order to reconcile it with the printed text; and thus the weapons of his antagonists were successfully turned against themselves. He appealed also to the writings of the Jews themselves upon the subject of the Hebrew text, and gave a compendious history of it, from the close of the Hebrew canon down to the invention of printing; together with a description of a hundred and three Hebrew manuscripts which he had discovered in England, and an account of many others preserved in various parts of Europe. A collation of the Hebrew manuscripts was now loudly called for by the most learned and enlightened friends of biblical criticism; and in the same year, 1760, Dr Kennicott issued his proposals for collating all the Hebrew manuscripts prior to the invention of printing, which could be found in Great Britain and Ireland, and for procuring at the same time as many collations of foreign manuscripts of note as the time and money he should receive would enable him to procure. His first subscribers were the learned and pious Archbishop Secker, and the delegates of the Oxford press, who, with that liberality which has generally distinguished them, gave him an annual subscription of L.40. In the first year the money received was about five hundred guineas; in the next it rose to nine hundred, at which sum it continued stationary till the tenth year, when it amounted to one thousand. During the progress of this work, the industry of our author was rewarded by a canonry of Christ Church. He was also presented, though we know not exactly when, to the valuable living of Mynhenyote, in Cornwall, upon the nomination of the chapter of Exeter. In 1776 the first volume was published, and in 1780 the whole was completed. If we consider that above six hundred manuscripts were collated, and that the whole work occupied twenty years of Dr Kennicott's life, it must be owned that sacred criticism is more indebted to him than to any other scholar of his age. Within two years of his death he resigned his living in Cornwall, from conscientious motives, on account of his not having a prospect of ever again being able to visit his parish. Although many good and conscientious men may justly think, in this case, that his professional labours, carried on elsewhere, might properly have entitled him to retain this preferment, and may apply this reasoning in other cases, yet conduct so signally disinterested certainly deserves to be admired and celebrated. Dr Kennicott died at Oxford, after a lingering illness, on the 18th of September 1783; and he left a widow, who was sister to Mr Edward Chamberlayne of the treasury. At the time of his death he was employed in printing Remarks on Select Passages in the Old Testament, which were afterwards published, the volume having been completed from his papers.

KENNINGTON, a hamlet adjoining to London, in the parish of Lambeth, in Surrey, a mile and a half from Westminster Bridge. It is one of those places in the vicinity of the metropolis which of late years have vastly increased in opulence and appearance. Two new churches, and numerous substantial houses, have been built. A palace formerly stood within it, which was inhabited by several of our monarchs, the last of whom was Henry the Eighth. It was destroyed in the civil war under Charles the First. A canal has been carried on to this place from the Thames, by which coals and other heavy articles are conveyed to it at a cheap rate.

KENRICK, William, an author of considerable ability, was the son of a citizen of London, and brought up, it is said, to a mechanical employment. This, however, he seems early to have abandoned, and to have devoted his talents to the cultivation of letters, by which he supported himself during the rest of a life which might be said to have passed in a state of warfare, as he was seldom without an enemy to attack or to defend himself against. He was for some time a student at Leyden, where he received the degree of doctor in both laws. Not long after his return to England, he attracted some notice as a poet by Epistles Philosophical and Moral, 1759, addressed to Lorenzo; an avowed defence of infidelity, written whilst under confinement for debt, and with a declaration that he was "much less ambitious of the character of a poet than of a philosopher." From this period he became a writer by profession; and the Proteus shapes under which he appeared it would be a fruitless attempt to trace. He was for a considerable time a writer in the Monthly Review; but having quarrelled with his principal, he began a new review of his own. When Dr Johnson's edition of Shakspeare first appeared in the year 1765, it was followed in a fortnight by a pamphlet, entitled a Review of Dr Johnson's new Edition of Shakspeare, in which the ignorance or inattention of that editor is exposed, and the poet defended from the persecution of his commentators. This pamphlet was followed by an examination of it, and that by a Defence in 1766, in which year he produced his pleasant comedy of Falstaff's Wedding, at first intended to have been given to the public as an original play of Shakspeare retrieved from obscurity, and which, it must be acknowledged, is a happy imitation of the great dramatic bard. With the celebrated English Roscius Dr Kenrick was at one time on terms of the strictest intimacy; but he took occasion to quarrel with him in print, and in a mode too unmanly to be mentioned. In politics also he made himself not a little conspicuous, particularly in the dispute between his friends Wilkes and Horne. He was the original editor of the Morning Chronicle; but being ousted for neglect, he set up a new one in opposition. He translated in a very able manner the *Emile* and the *Héloise* of Rousseau; the Elements of the History of England by Millot; and produced several dramatic performances, together with an infinite variety of publications both original and translated. To him also the public are indebted for the collection, imperfect as it is, of the poetical works of Robert Lloyd, 1774, in two vols. 8vo. Dr Kenrick died on the 9th of June 1777.

KENSINGTON, a large parish, whose boundary joins to London, in the hundred of Ossulton, in the county of Middlesex. It is chiefly remarkable for the royal palace and gardens, the latter of which forms the scene of the recreation of the inhabitants of the metropolis. The palace is an irregular brick building, purchased by William the Third, and by him and his successors enlarged in various styles. Though with little exterior taste, it has good suites of apartments allotted to junior members of the royal family, and to other persons. The gardens have received all the advantages of which their situation is capable, and form a most pleasing promenade. Holland House and other mansions are objects of remark within this parish, as well as the numerous smaller buildings erected within the last twenty years. The inhabitants amounted in 1801 to 8556, in 1811 to 10,386, in 1821 to 14,428, and in 1831 to 20,902.

KENT, a maritime county in England, and, reckon-

Kent.

ing its population, extent, and fertility, perhaps the first in the island. It is in a peninsular form, being bounded by the British Channel on the south; by the German Ocean on the east; by the river Thames, which divides it from Essex, on the north; and by the counties of Surrey and Sussex on the west. Its length is sixty-six, and its breadth thirty-six miles. The area is calculated at about 1300 square miles.

The divisions of Kent are into five laths, which are subdivided into sixty-three hundreds and fifteen liberties, and contain two cities, thirty-six towns, and 414 parishes.

The population, at the four decennial enumerations, amounted in 1801 to 307,624, in 1811 to 373,095, in 1821 to 426,016, and in 1831 to 479,155. At the last census the males were 234,572, and the females 244,583. These are comprehended in 97,142 families, of whom 31,667 are chiefly employed in agriculture, 29,419 are occupied in trade, manufactures, and handicraft, and 36,056 are not included in either of the other classes. The number of males above twenty years of age employed in retail trade or in handicraft, or masters or workmen, was 34,257.

The baptisms, burials, and marriages, show the following proportion at different periods, in the parish register:—

	One Baptism in	One Burial in	One Marriage in
1796 to 1800	30	41	116
1806 to 1810	29	38	115
1816 to 1820	31	51	130
1826 to 1830	34	49	143

Thus it is seen that the increase of population has been going on rather by a greater degree of longevity than by the increase of births. The only scale of morals which our present statistical knowledge supplies is that regarding chastity, by showing the proportion which the number of illegitimate children bears to the whole of the births. The illegitimates in Kent have only been one in twenty-four, whereas in the whole of England they were one in twenty; in the whole of Wales, one in thirteen; and in England and Wales taken together, one in nineteen.

The cities of Kent are two, and the towns whose houses and population exceed 3000 inhabitants, are—

Cities.	Houses inhabited.	Inhabitants.
Canterbury	3033	13,649
Rochester	1088	9,891
Towns.		
Greenwich	3665	24,553
Deptford	4386	19,795
Woolwich	2672	17,661
Chatham	2840	17,430
Maidstone	2844	1,538
Dover	2095	11,922
Tonbridge	1709	10,380
Margate	1808	10,339
Lewisham	1716	9,659
Ramsgate	1354	7,985
Deal	1391	7,268
Minster in Sheppey, with Sheerness	1430	7,922
Gravesend	756	5,097
Dartford	994	4,715
Sevenoaks	905	4,709
Milton	685	4,348
Bromley	669	4,002
Faversham	737	3,982
Cranbrooke	639	3,844
Folkstone	719	3,638
Bexley	601	3,206
Tenterden	548	3,177
Sandwich	595	3,136

By the law of 1832, entitled an act to amend the representation of the people of England, the county of Kent has been divided into the eastern and western parts. The election for the first of these is held at Canterbury, and the other polling places are Sittingbourne, Ashford, New Romney, and Ramsgate. The election for the second or western division is held at Maidstone, and the other polling places are Bromley, Gravesend, Tonbridge, and Cranbrooke. By the same act, the boroughs of New Romney and of Queenborough have been disfranchised; and the borough of Hythe, which before returned two members, can in future elect but one, and, to make up the competent constituency, the town of Folkstone has been added to it. Greenwich has by the same law been erected into a borough, and returns two members; and Chatham is also a borough returning one. The other places, viz. Canterbury, Rochester, Dover, Maidstone, and Sandwich, return, as before, two members each. Thus the representation consists of four members for the county, and fourteen for the cities and towns.

The extent of land in the county appears to be 996,480 acres when the whole area is included; but, from some not ascertainable cause, the returns from the several parishes show only 972,240 acres. The annual value of the land, including that of the houses, was taken in 1815, for the purpose of the property tax, at L.1,644,179. The whole of the poor-rates levied in 1833 amounted to L.450,851; and it had not much varied in the few preceding years.

The appearance of Kent is generally acknowledged to be equal, if not superior, in beauty, to that of any other British county. Its surface is gently undulating; none of its hills, except on the coast, rise abruptly, nor reach a great elevation. In all the valleys there are streams of water; the woods and trees enrich the scenery, and the mixture of pasture and corn land, interspersed with orchards, fruit-trees, and hop plantations, give to its beauties a character of softness and grace.

The Thames may be considered as a Kentish river, as it washes its whole northern boundary, and empties itself into the sea on its shores. The river next in importance is the Medway, formed by the junction of four small streams, one only of which rises within the county. It becomes navigable for large barges at Tunbridge, and continues its course by Maidstone to Chatham, where ships of the largest size can approach the shore; and there terminates its course, by joining the Thames at the Nore, beyond the arsenal of Sheerness. The Greater Stoure, the Lesser Stoure, the Rother, the Cray, the Darent, and the Ravensbourne, are small rivers, none of them navigable, but all of great benefit, by the fertility they communicate to the meadows on their banks, and by the power they afford to the many mills erected upon their banks.

Kent is almost exclusively an agricultural county; and though the soil is generally fertile, and though there are few extensive tracts of barren or uncultivated land, yet no part of the kingdom exhibits within so small a compass so great a variety of soils, of productions, and of modes of cultivation. It has been judiciously divided into eight districts for the purposes of agricultural description. The first of these, the Isle of Thanet, is in the north-west angle of the county. The soil is a light mould on a chalky bottom, and has been highly enriched by the marine substances that have been administered as manure. The whole island contains 23,000 acres of arable and 3500 acres of rich marsh land. The most common rotation of crops is fallow, sometimes with, sometimes without, a crop of peas: this is followed by barley, clover, and wheat; and on some soils rather heavier, the course pursued is beans, wheat, and barley. The barley of this district is very much esteemed, and sought for as seed in other countries. Besides the common grains, seeds of various kinds are raised for sale to the London seedsmen, particularly canary, radish, spinach, mustard, and onion seed. The soil in the marshy parts of the island is a mixture of clay, sea sand, and small shells, and yields most abundant pasture.

The upland farms of East Kent, which surround Canterbury, and extend to Dover on one side and Ashford and Rochester on the other, are an open and dry tract of corn land, intermixed with woods. The soils are very various, all resting on a subsoil of chalk. Some of them are very heavy loamy clays, with a great quantity of flint stones on the surface: these are usually cultivated on a four-course rotation of fallow, barley, beans, and wheat; when the soil is somewhat stiffer, a variation occurs of fallow, wheat, beans, and oats. In this district the harvest usually commences from twelve to fourteen days later than in the Isle of Thanet. The woods in this district usually supply poles to the hop-planters in the vicinity; they are cut down after from ten to fourteen years' growth. There are in this division some few hop grounds, but they are confined to three or four parishes. In the vicinity of Sandwich, Faversham, and Deal, a portion of land, of a rich sandy loam, receives an almost uniform cultivation; it is nearly all under the plough, and a four-course rotation is practised, of wheat, beans, barley, and oats, after a fallow, or sometimes canary occupies the place of wheat. Some portions of this land are alternately cropped with beans and wheat, or beans and canary. In the vicinity of Sandwich are many orchards, the apples of which are partly sent to London, and partly furnish return cargoes to the vessels that come laden with coals from Newcastle and Sunderland.

The district extending from Maidstone to Canterbury, and thence to Sandwich, is the great garden-tract for the growth of hops. The soils on which hops are produced are very various: the most productive are those which have a deep loam surface, with a subsoil of deep loamy brick earth; some of these have a considerable quantity of flint-stones mingled with the soil, and, when it becomes compact, almost covering it. Another soil, provincially called stone shalten, is very good for the growth of hops; it is mixed with many small portions of stone and sand, and rests upon the basis of the stone called Kentish rag, which is burned into excellent lime. The cultivation of hops is a very fluctuating pursuit, as the produce varies in different years from two to fifteen hundredweight per acre, and the prices have varied from three to fifteen pounds. The expense of cultivation is very great, from the quantity of manure that is required, from the great expense of the poles round which the plants twine, and the labour of keeping the ground clear and of picking the hops. Besides hops, the district is very productive of apples, cherries, and filberts, to the growth of which many fields, from one to ten acres in extent, are devoted: part of the apples are made into cider; the remainder, with the cherries and filberts, are principally conveyed to the different markets in London.

The Isle of Sheppey is separated from the rest of Kent by an arm of the sea called the Swale, which is navigable for ships of 200 tons burden. Its length is eleven, and its breadth eight miles. About four fifths of this island is either marsh or dry pasture-land; upon the former many oxen are fattened, and the latter is appropriated to the breeding and feeding of sheep. About 10,000 acres of this island is arable land, of great fertility, usually cultivated with beans and wheat in alternate years, with occasionally a fallow before the beans. This land is highly fertile, the wheat raised on it being considered as the best that is brought to London, a bushel frequently weighing sixty-four pounds. This great productiveness may be in some measure owing to the practice of applying to the natural heavy clayey soil a frequent dressing of the cockle shells which are washed on the beach by the sea. It is not unusual to apply thirty cart-loads of these shells to an acre of land. The uplands of West Kent are extensive and various in their soils. This part is more woody and enclosed than East Kent. The ridge of the chalk hills, about six or seven miles in breadth, consists of a stiff clay, with many surface flints, and requires six horses frequently to plough it. On these soils the most common rotation is a year's clean fallow, then wheat, clover, wheat, and oats. Many large flocks of South Down sheep are kept on this hilly range. The valleys and the sides of the hills are lighter soil and easier to work, but do not produce better corn; some of this, but not to a great extent, is cultivated for hops.

The district known as the Weald of Kent was, in former times, an immense forest, desolate of inhabitants, and only occupied by wild swine and deer; and though it is now filled with towns and villages, and well peopled, the woods that remain are extensive; exhibiting some pleasing landscapes, where seats, farms, and villages, are mixed with cultivated fields, and woods of spreading oaks. The roads in this district are very bad, many of them impassable for carriages in the best seasons; and, in winter, horses can only travel by keeping on the narrow paved tracts that are formed by the sides of the highways. The soil is principally clay, with a substratum of marl, in some places very heavy, but in others sufficiently light to be ploughed with oxen. This district produces wheat, oats, barley, rye-grass, clover, and beans; but so various are the rotations, that it is scarcely possible to generalise them. The pastures are very rich and fertile, and fatten annually great numbers of cattle. In the western part of this district, and in the adjoining Weald of Sussex, there were formerly many iron-works: the ore is found, and the abundance of wood made the manufacturing of it profitable; but the substitution of coke for charcoal in making iron has put a final stop to all the iron-works of Kent and Sussex.

The last agricultural division is a rich, level, extensive tract of land, on the southern coast, containing about forty-five thousand acres of the richest pasture in the united kingdom. This level is protected from the violence of the sea, and from inundations, by a dyke of earth of very great thickness, called Dimchurch-wall. The whole is alluvial land, consisting of a fine, soft, rich loam, with portions of sea-sand and broken shells intermixed. The subsoil consists of alternate layers of sand and clay mixed with shells, amongst which are sometimes found large oak trees in various positions, the wood of which is as black and as hard as ebony. On this plain there are two towns, Romney and Lydd, but scarcely any villages, and few other houses than those of the shepherds and herdsmen who attend upon the numerous cattle that graze on the marshes.

As there are no other fences but dykes, or posts and rails, from the surrounding heights it has the appearance of one large verdant field covered with sheep and oxen. The breeding and fattening of sheep is the principal purpose to which this level is appropriated, and the number bred is greater than on any other tract of the same extent in the kingdom. The sheep take their denomination from the district; they are larger than the South Downs, but not of a size equal to the Lincolnshire sheep. Their flesh is highly esteemed in the London markets, and their wool is both fine and of a long fibre; the average weight of the fleeces being about five pounds.

The landed property of Kent is much divided; there are some noblemen that have large, but none such vast estates as to give a preponderating political influence. The number of freeholders exceeds ten thousand, enjoying estates from the smallest value that can give a vote, and gradually rising to L.7000 or L.8000 per annum. The copy-hold tenures are very few, and the peculiar tenure of Kent, known as *gavel-kind*, is very much diminished by various legal operations.

The chief manufactures carried on in this county are those connected with the building and equipping of ships and boats. The males above twenty years of age employed in the several branches of ship-building, block, rope, and sail making, amount to 2120; to which are to be added, nearly as many plumbers, glaziers, painters, joiners, ironmongers, copper-smiths, and other trades who are occupied more in shipping than in other kinds of business. The larger operations of the kind are carried on in the king's yards at Deptford and Woolwich; but there are many private yards for building and repairing ships on the south bank of the Thames. At Woolwich, the great manufactory of warlike stores, for the use of the artillery chiefly, gives occupation to many labourers exclusively of the soldiers. There mortars and brass cannon are cast, bored, and mounted, the different kinds of shot prepared, and all the various combustibles used in war compounded; and in the dockyard at that place, some of the largest ships of war are always building or repairing. In Chatham, and at Rochester, the chief manufactories are those of the government, either for the navy or for the ordnance department. The private manufacturing establishments are not either numerous or extensive. The largest in value is paper, which is made at Maidstone and near Dover, of the best quality; but in other parts, where the water is adapted for the purpose, that trade is carried on; some especially near Westerham. The whole number of males above twenty years of age employed in making paper are 531, of whom 147 reside in the town of Maidstone. The grinding of wheat is a considerable trade, from the goodness of the wheat grown here, and the slight expense of conveying the flour by water to the great market of the metropolis. Some printing of calicoes is carried on, upon the banks of the river Cray. The principal of these works are at Crayford, where 124, and at Bexley, where forty males, above twenty years of age, are employed; but this trade, like that of making paper, gives occupation to many more females than males. At Dartford there are some large manufactories of gunpowder; at Deptford, of several chemical preparations; at Greenwich, of machinery and of combs; and at Maidstone, of bagging for hops.

One of the proudest ornaments of the nation, Greenwich Hospital, for the relief of disabled or aged seamen, is in this county; and, in the park contiguous to it, the Royal Observatory, to which the eyes of all the navigators of Europe are directed, as the place from which issues the nautical ephemeris, which all nations depend on when traversing distant seas.

Though Kent is bounded on three sides by the ocean and the river Thames, it has scarcely any foreign commerce. The harbours are none of them good; those of Dover and Ramsgate are formed by artificial piers, and the former is dry at low water when the sluices are open. The only trade from Dover is to Calais, Dunkirk, and Ostend, for such light goods as can bear the expense of land-carriage. There is a herring fishery conducted from Folkstone; besides which, the principal foreign trade consists in smuggling those various articles whose high duties offer a temptation to encounter such perilous adventures.

The sea-shores in this county invite numerous visitors, who frequent and fill various towns during the warm months of summer. The principal of these are Margate, Ramsgate, and Broadstairs; but, besides these, many of the smaller places on the coast are resorted to for purposes of health or amusement. On the western side of the county, the waters of Tunbridge have long been celebrated; and though the influence of fashion has erected into rivals several other Spas, yet the company that still resort to it is both numerous and respectable.

(See Marshall's *Survey*; Boys's *Survey*; Brayley's *Beauties of England and Wales*; and Hasted's *Kent.*)

KENTIGERN, St, or St Mungo, a famous saint of the Catholic church, who flourished in Scotland in the sixth century, and is said to have been of the royal blood of both Scotch and Picts, being the son of Thametis, the daughter of Loth king of the Picts, by Eugene III. king of Scotland. The bishoprics of Glasgow and St Asaph were founded by him in 560. He obtained the appellation of *Mungo* from the affection of his tutor St Serf or Servanus, bishop of Orkney, who called him *Mongah*, which in the Norwegian language signifies *dear friend*.

KENTISH Town, a hamlet of the parish of Pancras, in the hundred of Ossulton, in the county of Middlesex. It has of late so much extended its buildings, that it almost forms a suburb to the metropolis. It is finely situated in a valley, beginning between the hills of Hampstead and Highgate; and being deemed a remarkably healthy spot, is much occupied with country residences of persons connected with London; and within the last ten years it has assumed an elegant appearance. There is a chapel of ease, and some dissenting places of worship.

KENTON, a parish of the county of Devon, in the hundred of Exminster, 178 miles from London. It is situated on the river Ex, where the Ken falls into that stream. The inhabitants amounted in 1801 to 1639, in 1811 to 1793, in 1821 to 1891, and in 1831 to 2050.

KENTUCKY, one of the United States of North America, is bounded on the north by the river Ohio, which separates it from Ohio, Illinois, and Indiana; on the east by Virginia; on the south by Virginia and Tennessee; and on the west by the river Mississippi. It extends from long. 81. 50. to 89. 29. W., and from lat. 36. 30. to 39. 10. N. Its extreme length is 380 miles, its medium breadth is about 100, and it contains an area of 38,000 square miles.

Kentucky is said to possess larger quantities of fertile land than any other western state; and, for beautiful variety of hill and dale, the general excellence of the soil, and picturesqueness of landscape scenery, including fine forests, and numerous streams and rivers, few countries surpass it. Yet there are in this state large sterile tracts, and a good deal of land either too mountainous or too poor for cultivation. The Allegany Mountains stretch along its eastern and south-eastern boundary, and branches from that chain penetrate into the counties contiguous to Tennessee and Virginia, rendering them broken and hilly. These offshoots from the larger mountains wind round the basis of the small table hills, and open up into frightful chasms, shaded by the gigantic poplar. A tract from five to twenty miles wide along the banks of the Ohio has the same character, but it is interspersed with fertile valleys. Between this strip of land, Green River, and the eastern counties, lies what has been called the garden of the state; it is the most populous part, and is distinguished for its beauty and fertility. It has a finely diversified or rolling surface, the soil is excellent, and there is abundance of timber and grape vines. It is about one hundred and fifty miles in length, and from fifty to one hundred in breadth. From three to ten feet beneath the surface, there is a substratum or floor of limestone. A great quantity of this mineral in a dissolved state is intermixed with the soil, and imparts to it a warm and forcing quality, highly favourable to the progress of vegetation. Much of it belongs to that species of soil technically called "mulatto land." Through this beau-

Kentucky. tiful country meander the Little Sandy, Licking, Kentucky, and Salt Rivers, with their numerous tributaries. There are a few precipitous hills, but no elevations of a magnitude sufficient to entitle any part of it to the character of mountainous. The woods have a very fine appearance, and seem as if they had been promiscuously arranged for a pleasure ground. Grape vines of vast size climb the trees, and overshadow the verdure beneath with their umbrageous leaves. Black walnut, black cherry, honey-locust, buck-eye, pawpaw, sugar-tree, mulberry, elm, ash, hawthorn, coffee-tree, and the grand yellow poplar trees which indicate the richest soil, are everywhere abundant. When the country was first settled, it was covered with a thick cane brake; but this has now given place to a beautiful grass sward. In the early part of spring, the May-apple throws out its rich and beautiful verdure in abundance, which, along with the purple and redundant flowers of the red bud, and the fine white blossoms of the dogwood, impart a delightful charm to the landscape. The trees are not in general large, but tall, straight, and tapering at the top. Innumerable branches wind amongst the copses; and in the declivities numerous springs of water, impregnated with lime, gush forth. In the south-western part of the state, between Green and Cumberland Rivers, there is a large tract of country, called "barrens," covered with grass like a prairie, and affording a fine range for cattle. Within these few years it has been planted with different kinds of trees, which, however, do not check the growth of the grass, or an infinite variety of plants, which enamel the sward, and during spring and summer flower in all the wild and luxuriant beauty of a western wilderness. Spread over this district are an immense number of small conical hills, called "knobs," covered with shrubby and post oaks. The soil is of an excellent quality, being a mixture of clay loam and sand; and fine tobacco is raised by many of the farmers. Of this state in general, an American writer observes: "For variety of hill and dale, for the excellence of the soil, yielding in abundance all that is necessary for comfortable subsistence, for amenity of landscape, beauty of forest, the number of clear streams and fine rivers, health, and the finest development of the human form, and patriarchal simplicity of rural opulence, we question if any country can be found surpassing Kentucky."[1]

A long extent of the northern frontier of this state is washed by the Ohio River; and the Mississippi passes a considerable part of the south-western boundary. Most of the rivers which have their origin within the limits of Kentucky rise in the southern part of it, and flow in a northerly direction into the Ohio. The river from which the state derives its name rises in the south-eastern portion, and interlocks with the head waters of Licking and Cumberland Rivers, the former having its origin in the north-east, and the other in the south-east corner. The Kentucky is an important stream, navigable for one hundred and eighty miles during winter, with a rapid current, and high, and in some parts perpendicular, banks of limestone. It takes a north-west course, and joins the Ohio at Port William, seventy-seven miles above Louisville, after receiving various tributary streams. Licking waters a rich and well-settled country, and, after a sinuous course of two hundred miles, enters the Ohio at Newport, opposite Cincinnati. Cumberland River waters eighty miles of this state, when it enters Tennessee; but crosses again into Kentucky, and, after running fifty miles in it, once more returns to Tennessee, which it leaves a second time to traverse the sister state. The river Big Sandy rises in the Allegany Mountains, and forms the eastern boundary of the state for nearly two hundred miles. During its progress it receives a great number of large creeks, and, before it enters the Ohio, separates into two branches or forks. It is navigable for a considerable distance. Green River is boatable for two hundred miles, and receives a great number of tributaries in its course. Salt River is boatable for one hundred and fifty miles, and, traversing four counties, enters the Ohio twenty miles below Louisville. There are a great many mineral springs, possessing medicinal qualities, some of which are really valuable. A fountain of petroleum, vulgarly called mineral oil, was discovered at the depth of one hundred and eighty feet, whilst the ground was being pierced to obtain salt water. When the auger was withdrawn, the unctuous matter sprung perpendicularly upwards in a continued stream, more than twelve feet above the surface of the earth. The rocks of this state are said all to belong to the secondary formation. Limestone and marble of the most beautiful species abound. Coal has been discovered in some places, especially along the Ohio. Iron ore is very abundant, and wrought to a considerable extent. Lead, copperas, and aluminous earths are likewise found. There are a number of salt springs, from which salt was formerly obtained; but it is now found more profitable to import it from other states. The soil of Kentucky is strongly impregnated with nitre; and it has been affirmed that fifty pounds of that salt, in a crude state, have been obtained from only double the quantity of earth. There are many natural curiosities and antiquities in this state; the limestone caves in particular excite the astonishment of all who visit them. One, styled Mammoth Cave, in the south-western part, one hundred and thirty miles from Lexington, on the road leading to Nashville, is said to be eight or ten miles in length, with a great number of avenues and windings. The famous cave of Antiparos is nothing to this stupendous subterranean cavity. A number of the rivers have excavated the earth, so as to form abrupt precipices, deep glens, and frightful gulfs. The precipices formed by Kentucky River are in many places awfully sublime, presenting perpendicular banks of three hundred feet of solid limestone, surmounted with a steep and difficult ascent four times as high.

Amongst the antiquities of Kentucky are great numbers of those Indian mounds which are scattered over all the western territory. Human bodies have been found in a state of entire preservation in several caves; they are said to be considerably smaller than the men of modern times.

The fertile soil of Kentucky produces all the grains, pulses, and fruits of the temperate climates, in great abundance; and, in the south-western counties, near and on the Tennessee, Cumberland, and Mississippi Rivers, cotton is grown. Hemp, tobacco, and wheat are the staple productions, but Indian corn is the principal grain raised for home consumption. Rye, oats, buck-wheat, barley, flax, potatoes, and other culinary vegetables, are cultivated. Apples, pears, peaches, cherries, and plums, are the most common fruits; but grapes are raised in many places, and there are vineyards where wine is made. This state is distinguished for its breed of domestic animals, particularly the horse, which is of the noblest kind, and reared in great numbers. These, along with mules, horned cattle, and swine, are annually driven to the neighbouring states for a market. The fattening of animals is the chief mode of consuming the surplus grain, on account of the expense of conveying it to market. Considerable quantities of whisky are made; and, from its position and fairs, Kentucky has become a manufacturing state. The present exports are chiefly to New Orleans, though a considerable quantity of produce and manufactures ascends

[1] *The History and Geography of the Mississippi Valley*, by Timothy Flint, p. 348.

Kentucky. the Ohio to Pittsburgh. The growers of the produce of this state, after arriving at New Orleans, frequently ship it on their own account to the Atlantic states, to Vera Cruz, and the West Indies. Besides the articles above mentioned, there are sent out of this state immense quantities of flour, lard, butter, cheese, pork, beef, Indian corn, and meal; whisky, cider, cider royal, fruit both fresh and dried; and various kinds of domestic manufactures.

With regard to the amount of the exports of surplus produce, an American writer on commerce observes, "from that part of the state of Kentucky which lies north and east of Kentucky River, and a few countries bordering on its south side, the exports in 1832 were valued as follows, viz.

Hogs, alive, and in pork, bacon, lard	1,000,000 dollars.
Horned cattle	200,000
Horses and mules	500,000
Hempen fabrics	750,000
Tobacco	150,000
Iron castings, pigs and bars	50,000
Wool, ginseng, &c	100,000
Total	2,750,000

Estimating the surplus produce of the remainder of Kentucky at two millions and a half, we shall have for that state 5,250,000 dollars."[1]

Kentucky is divided into eighty-three counties, each having a county town. Frankfort, the political metropolis of the state, is situated on the north bank of the Kentucky, sixty miles above its confluence with the Ohio. Long. 84. 40. W. Lat. 38. 14. N. The site of the town is a semicircular plain, some two hundred feet lower than the table-land in its rear. The environs of the plain are remarkable for their romantic and splendid scenery. The river is here about eighty yards wide, flowing between banks four or five hundred feet high, and dividing the town into about two equal parts, which are connected by a bridge. Amongst other public buildings, are the state-house, court-house, penitentiary, jail, three churches, an academy, and a county court-house. The state-house is entirely built of marble, and contains the customary legislative halls, and other apartments. This town contains rope-walks, cotton bagging manufactories, a cotton factory, tobacco warehouses, powder-mills, and other establishments. Being at the head of steam-boat navigation on the river, it is a place of considerable commercial enterprise. The population amounts to 4000.

Lexington, the largest and wealthiest town of the state, is finely situated, twenty-five miles east-south-east of Frankfort, in a beautiful valley on Town Fork, a small stream which falls into the southern branch of Elkhorn River. It is regularly laid out, and contains many large and handsome buildings. Those of a public nature are, the court-house, a handsome and spacious edifice; the bank; a large masonic hall; a spacious and commodious lunatic asylum; a number of churches, in which all denominations of Christians are represented; a market-house; an academy; and the Transylvania university, which has a high reputation. The manufactures of woollen, paper, and cotton are considerable; but the articles chiefly made are cotton-bagging, and various kinds of cordage, particularly bale-rope. Of the former there were manufactured, in 1830, 1,000,000 yards, and of the latter 2,000,000 pounds. The environs of this town are much admired for their beauty and cultivation; and they are adorned with a great number of handsome villas and ornamented rural mansions. The growth of Lexington has been very rapid. In 1797 it contained only about fifty houses; and the last census gives a population of 6104. Long. 84. 18. W. Lat. 38. 6. N.

Louisville, in a commercial point of view, is by far the most important town in the state. It is situated opposite the falls of the Ohio, fifty miles west of Frankfort; and its locality gives it the advantage of being the great outlet of a large portion of the surplus produce of the state. It is regularly laid out, and is three miles in length by upwards of one in breadth. The public buildings are, a court-house, jail, a number of houses of public worship, a poor-house, free public school house (a fine edifice), a marine hospital (a conspicuous and showy building), a bank, a theatre, and others of less importance. The private buildings are mostly of brick; and the warehouses, particularly those recently erected, are very extensive. Manufactures are as yet comparatively in their infancy. There is one manufactory of cotton and one of woollen, three iron founderies, a steam-engine factory, tanneries, hat, saddle, and shoe making establishments, and the like. The exports are, tobacco, whisky, cotton bagging and baling, hemp, flour, pork, bacon, lard, and many other productions of the country. The imports are various and extensive, the easy circumstances of many of the people creating a large demand for foreign articles of comfort and luxury. The commerce is carried on by upwards of three hundred steam-boats, some of which are daily arriving from or departing for all parts of the immense valley of the Mississippi. Amongst the public works connected with this rising town, is the Louisville and Portland Canal, which is two miles in length, and calculated to admit of the passage of the largest steam-boats on the western waters. Its top-water line is two hundred feet, its bottom fifty feet, and its depth varies from four to forty-two feet. Its sides are sloping and paved with stone, and it has over it a beautiful stone bridge between Louisville and Portland. Its locks consist of a guard-lock and three lift-locks, which are larger than any in the United States. It cost 940,000 dollars, and was opened on the first of January 1831. An idea of the extent of the commerce carried on by means of this medium of inland navigation may be formed from the following statement of the number of steam-boats, and flat and keel boats, which passed in 1832, 1833, and one half of 1834:—1832, 453 steam-boats, 179 flats and keels, 70,109 tons; 1833, 875 steam-boats, 710 flats and keels, 169,885 tons; first half of 1834, 630 steam-boats, 139 flats and keels, 98,122 tons.

The county of which Louisville is the capital is one of the most fertile and best settled in the state, and the town is considered as one of the greatest thoroughfares in the union. The city government consists of a mayor and city council, chosen annually by the *viva voce* vote of all residents in their respective wards. The census of 1830 assigns to it a population of 10,352, but the increase has been exceedingly rapid since that period. Long. 85. 30. W. Lat. 38. 3. N.

The next town to Louisville, in point of commercial importance, is Maysville, situated on the Ohio, sixty-three miles north-east of Lexington. It is indebted for its importance chiefly to its being the principal place of importation for the north-eastern part of the state. Glass and some other articles are manufactured to a considerable extent. It possesses a fine harbour for steam-boats, a number of which have been built here, and is altogether a thriving, busy town. The population amounts to about 4000. Washington, three miles south of this place, is a considerable village, in the centre of a well-peopled country. It possesses the usual number of public buildings, such as court-house, jail, seminaries of learning, together with the customary stores and mechanics' shops, and also a branch of the Kentucky bank. Paris, the chief town of Bourbon

[1] *A Statistical View of the Commerce of the United States of America.* By Timothy Pitkin, 1835.

county, is central to a delightful and populous country, and is entirely an interior town, twenty miles east of Lexington. Some of the houses have a spacious appearance; and it contains some manufactories of cotton bagging and rope-walks, with a population of 1200. Georgetown, the county town of Scott county, is situated in a fine, rich tract of country, and contains a number of considerable manufacturing establishments, handsome private houses, and some public buildings. Newport, opposite to Cincinnati, is the county town for Campbell county, and is situated at the mouth of Licking River. It has a spacious arsenal, containing arms and munitions of war, and also some other public buildings. Bagging, cordage, and tobacco are manufactured here. Covington, situated below Newport, and on the opposite side of the Licking, is laid out with great regularity. It is intended that the streets shall be continuations of those of Cincinnati, and liberal donations have been made for the erection of public buildings. In this place are respectable manufacturing establishments, particularly of cotton. Russellville, the county town of Logan county, is an interior town, intermediate between Green and Cumberland Rivers, and thirty-five miles distant from each. It contains a seminary denominated a college, and a number of respectable public buildings. Salt lakes abound near the town, and many of the prairies in the vicinity are of great beauty. There are a great number of other towns and villages in this state, but it would be an unnecessary repetition to enumerate them particularly. They all possess public buildings and manufactures corresponding to their size or situation. We have mentioned one great public work belonging to Kentucky, the Louisville and Portland Canal. Another of a very important nature deserves mention, namely, a railroad extending from Lexington, through Frankfort, to Louisville, a distance of about ninety miles. The work was begun in 1832, and in January 1835 it was completed as far as Frankfort, a distance of twenty-eight miles. It is substantially built, and estimated to cost, when finished, 1,032,000 dollars.

The first permanent settlement of this state was begun on Kentucky River in 1775, by Colonel Daniel Boone. The county formed a part of the state of Virginia till 1790, and in 1792 was admitted into the union as an independent state. The constitution then adopted continued in force till 1799, when the one which now exists was formed.

The legislative power is vested in a senate and house of representatives, which together are styled the General Assembly of the Commonwealth of Kentucky. The representatives are elected annually, and are apportioned, every four years, among the different counties, according to the number of electors. Their present number is one hundred, which is the highest number that the constitution authorizes; fifty-eight being the lowest. The senators are elected for four years, one quarter of them being chosen annually. Their present number is thirty-eight; and they cannot exceed this number, nor fall short of twenty-four. The executive power is vested in a governor, who is elected for four years, and is ineligible for the succeeding seven years after the expiration of his term of office. At the election of governor, a lieutenant-governor is also chosen, who is speaker of the senate, and on whom the duties of the governor devolve in case of his absence or removal. The representatives and one quarter of the members of the senate are elected annually by the people, on the first Monday in August; the governor is elected by the people, every fourth year, at the same time, and he commences the execution of his office on the fourth Tuesday succeeding the day of the commencement of the election at which he is chosen. The polls are kept open three days, and the votes are given openly, or *viva voce*, and not by ballot. The general assembly meets (at Frankfort) annually, on the first Monday in November. The constitution grants the right of suffrage to every free male citizen (people of colour excepted) who has attained the age of twenty-one years, and has resided in the state two years, or in the county where he offers his vote one year, next preceding the election. The judiciary power is vested in a supreme court, styled the court of appeals, and in such inferior courts as the general assembly may from time to time erect and establish. The judges of the different courts, and justices of the peace, hold their offices during good behaviour. The state is divided into sixteen circuits or districts, to each of which there is attached a circuit judge.

The religious bodies of Kentucky stood in 1830 as follows: Baptists, twenty-five associations, 442 churches, 289 ministers, and 37,520 communicants; Methodists, seventy-seven preachers, and 23,935 members; Presbyterians, 103 churches, sixty-one ministers, six licentiates, and 7832 communicants; Roman Catholics, about thirty priests; Episcopalians, five ministers. What are called Cumberland Presbyterians are also numerous.

The principal literary institution is Transylvania university, at Lexington. It is under the patronage of the state, and in 1830 contained one hundred and forty-three graduates, sixty-two in the preparatory department, two hundred medical students, and nineteen law students. There are also other colleges in different parts of this state, supported by religious societies, viz. St Joseph's, at Bardstown, by the Catholics; Centre College, at Danville, by the Presbyterians; Augusta College, at Augusta, by the Methodists; Cumberland College, at Princetown, by the Cumberland Presbyterians; and Georgetown College, at Georgetown, by the Baptists. Many years since, the state appropriated 6000 acres of land for the purpose of endowing an academy in each county; but little public benefit has yet flowed from this source. Steps have been repeatedly taken for the purpose of introducing a system of common schools, but not with the effect which could have been desired. The general state of education in Kentucky may be gathered from a document furnished by the census of 1830. A committee had been appointed by the house of representatives to examine the subject, but the returns made to that body appear to be very inaccurate. If, however, we take those counties from which correct returns are supposed to have been made, it would appear that the number at school does not amount to more than one third of the aggregate number of children.

The first newspaper in Kentucky was printed at Lexington in 1786. The number printed in the state in 1810 was seventeen, and in 1834 twenty-five. There is a journal of medicine published, and some other periodicals have been attempted.

By a return, dated the 30th of August 1834, the bank in Kentucky stood thus: Capital, 1,079,435 dollars; notes issued, 450,000 dollars; specie and specie funds, 240,690 dollars; deposits, 250,000 dollars; discounts of notes, &c. 1,500,000. The postage received in Kentucky for the year ending 31st March 1832 amounted to 42,979·30 dollars. The population of this state by the census of 1830 was 688,844, of whom 165,350 were slaves. (R. R. R.)

KENWYN, a parish in the county of Cornwall, within the hundred of Powder, 257 miles from London. It joins the town of Truro, and forms a kind of suburb to it. The inhabitants amounted in 1801 to 4017, in 1811 to 5000, in 1821 to 6221, and in 1831 to 8492.

KENZINGEN, a city, the capital of the bailiwick of the same name, in the circle of Treisam, in the duchy of Baden. The bailiwick comprehends two towns, twenty villages and hamlets, peopled by 12,100 souls. The city stands on the river Elz, in a fine situation, containing 460 houses, and 2430 inhabitants. It is surrounded with walls, and is a place of some trade, especially in leather. Near to it is the well-frequented baths of Birnhalden.

KEOUNSAY, a town of the Burman empire, situated on the eastern bank of the Irrawaddy River; and, like all the other towns in this country, the houses are raised several feet above the ground, upon piles. Long. 96. 40. E. Lat. 17. 20. N.

KEPLER, John, one of the most eminent astronomers who have appeared in any age, was born at Wiel, on the 27th of December 1571. His father's name was Henry Kepler, an officer of distinction in the army of Wirtemberg, but reduced to poverty by numerous misfortunes. This exposed young Kepler to many difficulties and interruptions whilst acquiring the rudiments of his education; but such was his genius and his avidity for knowledge, that he surmounted every difficulty, and made astonishing proficiency. He studied at the university of Tubingen, where he obtained the degree of bachelor in the year 1588, and that of master of philosophy in 1591. In the year 1592 he applied himself to the study of divinity; and the sermons he produced afforded sufficient indication that he would have excelled as a preacher had he continued in the clerical profession. The mathematics, however, became his favourite study; and he soon acquired such distinguished reputation as a geometrician, that he was invited to Gratz in Styria in the year 1594, to fill the mathematical chair in the university of that city. After this period his chief attention was directed to the study of astronomy, and he made many interesting discoveries respecting the laws of the planetary motions.

Two years after his marriage with a lady descended from a noble family, persecution on account of his religion compelled him to quit Gratz, to which he was afterwards recalled by the states of Styria. The calamities of war, however, induced him to look out for a residence where he might enjoy greater safety and tranquillity. During this uncomfortable situation of affairs, the celebrated Tycho Brahe strongly urged him to settle in Bohemia as his assistant, where he himself had every necessary requisite furnished to him by the Emperor Rodolph for the prosecution of his astronomical studies. The numerous and urgent letters which Kepler received upon this subject, and the solemn assurances that he should be introduced to the emperor, at length induced him to leave the university, and settle in Bohemia with his family, in the year 1600. But on his way to that country he was seized with a quartan ague, which afflicted him for seven or eight months, and rendered him incapable of contributing that aid to Tycho which he would otherwise have done. He was likewise displeased with the conduct of this astronomer towards him, and thought that he behaved in an unfriendly manner, by neglecting to do a material service to his family when he had it in his power. Kepler further considered him as by far too reserved, in not communicating to him the whole of his discoveries and improvements. Tycho died in the year 1601, and the intercourse between these two eminent men being thus of short duration, precluded Kepler from being either serviceable to, or deriving much advantage from, the investigations and researches of the Danish astronomer. Kepler, however, was introduced to the Emperor by Tycho, in conformity to his promise, and appointed mathematician to his imperial majesty, with instructions to complete the Rodolphine Tables, which that great man had commenced. These were not published till the year 1627, owing to a variety of obstructions and difficulties which were thrown in his way. Two years after the publication of this work, he went, by permission of the emperor, to Ratisbon, to claim payment of the arrears of his pension, but he was there seized with a violent fever, supposed to have been brought upon him by too hard riding; and to this he fell a victim in the month of November 1630, in the fifty-ninth year of his age.

The learned world is indebted to this sagacious and able astronomer for the discovery of the true figure of the planetary orbits, and the proportions of the motions of the solar system. Like the disciples of Pythagoras and Plato, Kepler was seized with a peculiar passion for finding analogies and harmonies in nature; and although this led him to the adoption of strange and ridiculous conceits, we shall readily be disposed to overlook these, when we reflect that they were the means of leading him to the most important discoveries. He was for some time so charmed with the whimsical notions contained in his *Mysterium Cosmographicum*, published in 1596, that he declared he would not give up the honour of having invented what was contained in that book for the electorate of Saxony; so easy is it for the greatest of men to be deceived by a favourite hypothesis.

He was the first who discovered that astronomers had been mistaken in ascribing circular orbits and uniform motions to the planets, since each of them moves in an ellipsis having one of its foci in the sun; and, after a variety of fruitless efforts, he, on the 15th of May 1618, made his splendid discovery, that the squares of the periodic times of the planets are always in the same proportion as the cubes of their mean distances from the sun. As it was long a favourite opinion of Kepler's that there are only six primary planets, he seems to have been alarmed at the discovery made by Galileo of four new planets, or satellites of Jupiter, which gave a deathblow to the doctrines contained in his *Mysterium Cosmographicum.* The sagacity of this wonderful man, and his incessant application to the study of the planetary motions, pointed out to him some of the genuine principles from which these motions originate. He considered gravity as a power that is mutual between bodies; that the earth and moon tend towards each other, and would meet in a point so many times nearer to the earth than to the moon as the earth is greater than the moon, if their motions did not prevent it. His opinion of the tides was, that they arise from the gravitation of the waters towards the moon; but his notions of the laws of motion not being accurate, he could not turn his conceptions to the best advantage. The prediction he uttered at the end of his epitome of astronomy has been long since verified by the discoveries of Sir Isaac Newton, namely, that the determination of the true laws of gravity was reserved for the succeeding age, when the Author of nature would be pleased to reveal those mysteries.

To this concise account of the illustrious Kepler we shall now add a list of his principal publications. These are, 1. Mysterium Cosmographicum, already mentioned, 4to; 2. Paralipomena ad Vitellionem, quibus Astronomiæ Pars Optica traditur, 1604, 4to; 3. De Stella Nova in Pede Serpentarii, 1606, 4to; 4. Astronomia Nova, seu Physica Cælestis, tradita Commentariis de Motibus Stellæ Martis, ex Observationibus Tyconis Brahei, 1609, folio; 5. Dissertationes cum Nuncio Sidereo Galilei, 1610; 6. De Cometis libri tres, 1611, 4to; 7. Ephemerides Novæ, from 1617 to 1620; 8. Epitome Astronomiæ Copernicanæ, in two volumes 8vo, the first published in 1618, and the second in 1622; 9. Harmonices Mundi, lib. v. 1619, 4to; 10. Chilias Logarithmorum in totidem numeros rotundos, 1624, 4to; 11. Supplementum Chiliadis, &c. 1625, 4to; 12. Tabulæ Rodolphinæ, 1627, folio; 13. De Jesu Christi Servatoris anno natalitio. He was also the author of several pieces connected with chronology, the mensuration of solids, and trigonometry, and of a treatise on dioptrics, an excellent performance for the period in which he flourished. See the Dissertations on the History of Physical and Mathematical Science prefixed to this work.

KEPPEL Bay, on the eastern coast of New Holland, discovered and so named by Captain Cook, who sailed past it in 1770. It was visited by Captain Flinders, who discovered that it communicated with Port Curtis. Long. of the anchorage, 150. 58. E. Lat. 23. 29. S.

KERAH, or Haweeza, and by the Turks called Karasu, a considerable river of Persia, which takes its rise in the mountains of Ardelan, in Kurdistan, from the junction of numerous streams. It makes its way through the plain of Kermanshaw, greatly increased by the contribution of two considerable rivers, the Kazawur and the Gamasu; after which it flows with a furious course through Chusistan, receiving in its progress the accession of many streams. It flows onward to the ruins of Shus, and the city of Haweeza, and enters the Shut-el-Arab about twenty miles below Korna.

KERBELA, or Meshed Hossein, a large and populous town of Irak Arabi, situated at the extremity of a very noble canal drawn from the Euphrates. This was called by the ancient geographers Vologesia, and is mentioned as an inconsiderable place. But since the death of Hossein, the son of Ali by Fatima, the daughter of the prophet, who was slain near this place, and is interred at it, it has greatly increased, from the numerous resort of pilgrims of the sect of Ali, who flock to it from all quarters, especially from Persia, to pay devotions at the shrine. It has five gates, a well-supplied bazar, and seven caravanserais. But the chief and the only ornaments of the city are, the tomb of Hossein, which is adorned with a lofty cupola, gilded by Nadir Shah; and a noble mosque, consecrated to the memory of Abbas, the half-brother of the Imam. The town is subject to the Turks, but the majority of the inhabitants are Persians. The environs of the town and borders of the canal are shaded by extensive plantations of palm trees; and the walls, which are upwards of two miles in circumference, were repaired some years ago, to secure the riches of the city against the incursions of the Wahabees, by whom it was plundered when that sect was more powerful. The canal of Kerbela, or Nahr Sares, though it now bears the name of Hossein, is more ancient than the days of Alexander. This place is fifty miles south-south-west of Bagdad.

KERCOLANG, an island in the Eastern Seas, and the largest of the Salibabo islands, estimated at from eighty to a hundred miles in circumference, and inhabited chiefly by Mahommedans. It is situated between the 4th and 5th degrees of north latitude, and about 126. 30. of east longitude.

KERESOUN, a sea-port of Rumiyah, in Asiatic Turkey, situated in a gulf of the Black Sea bearing the same name. It consists of about 700 ruinous houses, of which 500 are inhabited by Turks, 150 by Greeks, and fifty by Armenians, the only industrious portion of the community. The town is built on an elevated rocky promontory which bounds the bay, and is supposed to be the ancient Cerasus. The inhabitants trade with the Crimea. It is seventy miles west-south-west of Trebisond.

KERGUELEN'S Land, or Island of Desolation, an island in the South Indian Ocean, discovered by Kerguelen, a Frenchman, and visited in the year 1779 by Captain Cook. It occupies one degree and a quarter of latitude, and about two of longitude. It is almost totally destitute of vegetation, owing to the coldness and moisture of the climate; and is represented as one of the bleakest and most desolate places of the earth, the haunt of sea-birds and amphibious animals. Long. 69. 30. E. Lat. 49. 20. S.

KERI-CETIB, are various readings in the Hebrew Bible, *keri* signifying that which is read, and *cetib* that which is written. For where any such various readings occur, the wrong reading is written in the text, and that is called the *cetib;* and the true reading is written in the margin, with ק under it, and called the *keri.* It is generally said by the Jewish writers that these corrections were introduced by Ezra; but it is more probable that they had their origin from the mistakes of the transcribers after the time of Ezra, and the observations and corrections of the Masorites. Those keri-cetibs which are found in the sacred books written by Ezra himself, or which were taken into the canon after his time, could not have been noticed by Ezra himself; and this affords a presumption that the others are of later date. These words amount to about a thousand; and Dr Kennicott, in his *Dissertatio Generalis*, remarks that all of them excepting fourteen have been found in the text of different manuscripts.

KERINJA, a large walled town of Hindustan, in the province of Berar. It has a large reservoir of water. The latitude is not ascertained.

KERKOOK, a town of Asiatic Turkey, and the largest of Lower Kurdistan. It is the ancient Demetrias of Strabo, and the Corcura of Ptolemy. It is in the direct road from Bagdad to Mosul, fifty-nine furlongs from the former, and forty-one from the latter. The city is situated on a commanding eminence, nearly perpendicular on all sides, below which is an extensive suburb; and it still retains the appearance of a Roman fortress. A nearer examination of the town, however, disclosing the narrowness and filth of the streets, together with the meanness of the houses, leaves no doubt as to the character and habits of the people. The city is defended by a mud wall, and has two gates, seven mosques, fourteen coffee-houses, a museum, a caravanserai, an Armenian church, and twelve pieces of useless artillery on the bastions. In the suburbs are five mosques, nine small caravanserais, thirteen coffee-houses, three convents, and three catholic churches. The surrounding country is unequal in its surface, and on the north side is a low range of barren and rocky mountains. The population of Kerkook is estimated at 18,000, though Mr Kinneir does not think it can exceed 13,000. These consist of Turks, Armenians, Nestorians, and Kurds. Long. 43. 42. E. Lat. 35. 29. N.

KERMANSHAW, a handsome and flourishing town of Persia, in the western part of the province of Irak. It is situated on the south-western slope of a range of mountains, at the extremity of a large plain, through the centre of which runs the Kerah or Karasu. It has the appearance of a handsome city, exhibiting the glittering domes of mosques within, and the battlements and towers of lofty walls without. The present shah has made it the capital of the district, over which he has constituted his eldest son, Mahmoud Ali Mirza, the governor. This prince is daily adding to its importance, by the construction of modern defensive works, and the erection of various public edifices. The bazar was rebuilt on an extensive plan in 1818, when it was visited by Sir R. K. Porter; a magnificent palace was also finished at the same time. Kermanshaw is famous for a manufactory of fire-arms, and the villages in its vicinity for carpets of the most beautiful colours and fabric. Luxurious gardens surround the town, abounding in fruits of all kinds, but particularly in grapes of a delicious muscatel flavour. The population amounts to 15,000 families, amongst whom there are a few Christians and Jews. It is 140 miles north-east from Bagdad. Long. 46. 30. E. Lat. 34. 20. N.

KERMES, the name of an insect produced in the excrescences of a species of the oak.

Kermes Mineral, so called from its colour, which resembles that of vegetable kermes, is one of the antimonial preparations.

KERN, or Kerne, a term in the ancient Irish militia, signifying a *foot soldier*. Camden tells us that the armies of

Ireland consisted of cavalry, called *galloglasses;* and infantry, lightly armed, called *kernes*. The kernes were armed with swords and darts; and to the latter were fitted cords, by which they could recover them after they had been launched out.

KERREY, a large parish in the county of Montgomery, and hundred of that name, in North Wales, 179 miles from London. It is finely situated on a gentle eminence in a beautiful valley, and the country around it is highly fertile. A large proportion of the population is employed in making fine Welsh flannels. It has a fine old Gothic church, of most venerable appearance. The population amounted in 1801 to 1758, in 1811 to 1855, in 1821 to 2038, and in 1831 to 2199.

KERRY, a maritime county in the province of Munster, in Ireland, is bounded on the north by the estuary of the river Shannon, which separates it from the county of Clare; on the east by the counties of Limerick and Cork; on the south by the county of Cork and the Atlantic; and on the west by the same ocean. The tribe of the Juvernii inhabited this part of Ireland during the time when Ptolemy wrote. Previously to the English invasion, the O'Connors were in possession of its northern parts, the Moriartys of the middle, and the O'Sullivans and O'Donoghoes of the southern. The M'Carthys were also a powerful sept here; but their property afterwards fell into the hands of the Fitzgeralds, from whom was descended the Desmond family, the head of which exercised an authority nearly equal to that of sovereign in Kerry and the adjoining counties till the close of the reign of Elizabeth. The county was made shire-ground so early as 1210, by King John; but afterwards the southern part of it, together with a large portion of the county of Cork, as far as the mouth of the Blackwater, was formed into a palatinate in favour of the earl just named. After the attainder of the last Earl of Desmond, and the confiscation of his property, the county was portioned out amongst English adventurers, the principal of whom were the Dennys, the Brownes, and the Conways. It is at present divided into the eight baronies of Clanmaurice, Corkaguiney, Dunkerron, Glanerough, Iraghticonnor, Iveragh, Magonihy, and Trughenachmy. It extends over a surface of 1,148,720 acres, of which 581,189 acres are cultivable land, 552,862 acres are mountain and bog, and the remaining 14,699 acres are covered with water. The average length and breadth of Kerry is sixty miles from north to south, by fifty-four from east to west.

The county contains the two dioceses of Ardfert and Aghadoe, which have from time immemorial been united so intimately that the parishes belonging to each cannot be ascertained. In 1663 they were both allowed to be held in commendam by the Bishop of Limerick, and the union thus formed has not been since disturbed. This union of dioceses is the only one that has not been in some manner altered by the late arrangements for the reduction of the number of Irish bishoprics. The diocese of Ardfert includes the northern part of the county; the seat of the see is Ardfert, a small town, now little more than a village. The cathedral was burned in the wars of 1641. A small part of the building was afterwards fitted up for divine service, and has been since kept in decent repair. The seat of the diocese of Aghadoe, which comprehended the southern part of the county, is at a place of the same name, near Killarney, where the ruins of the cathedral are still to be seen. The number of parishes in the united dioceses is eighty-eight, five of which are in the county of Cork.

The land in the northern part of the county is low and level, although it rises to a considerable elevation at the north-western promontory of Kerry Head, which presents an elevated summit to the fury of the Atlantic. The middle part is an upland, gradually rising to the east and south; the southern is wholly mountain and glen, having in it some of the highest points in Ireland. The loftiest of these is Garran-Tual, 3410 feet above the sea, being the summit of the range called M'Gillycuddy's Reeks, which stretches across the barony of Dunkerron, sending out several branches in various directions. Of these, Mangerton, stretching towards the east, is the next in elevation, being 2550 feet high; more eastward of which are the Paps, rising to a height of 2280 feet; and between both these, Turk, Glena, and Tomies Mountains, all of elevations little inferior. To the west are the mountains of Drung and Cullee, each 2000 feet high, separating Dunkerron from Iveragh, in which latter barony or peninsula are the lofty summits of Knockalin, 2150 feet, Knockadubber, 2000, and Knockatubrid, 1556 feet high. More northerly are Brandon Hill, Slieve Mish, the Stacks, and the Glanruddery Mountains, all of inferior elevation to those already mentioned. These mountain ranges are intersected by deep and precipitous glens, possessing features of sublime and picturesque scenery. One, called the Gap of Dunlo, lying between Tomies and M'Gillycuddy's Reeks, is formed by mountains on each side, nearly perpendicular, and opens into a valley watered by a succession of mountain lakes, and terminated by a romantic waterfall. These valleys are the beds through which numerous rivers take their course. The most northern rivers are the Feale, Gale, and Brick, which, having formed a junction near Rattoochurch, discharge their united streams, under the name of the Cashen, into the estuary of the Shannon. The Mang passes by Castlemaine, and empties itself into Dingle Bay. The Flesk, after a winding course through Glanflesk, falls into the Lake of Killarney, from which it passes, under the name of the Laune or Lane, with a body of waters much augmented, into Dingle Bay. The Carra, rising in the mountains of Dunkerron, falls into the same bay. The Fahrta and the Inny rise in Drung Mountain, and flow westward, the former into Valentia Harbour, the latter into Ballinskelig's Bay. The Roughty empties itself into the head of the estuary called Kenmare River. The Blackwater forms part of the boundary between this county and Cork. Lakes are numerous, but few of large size. The principal is the Lake of Killarney, celebrated for its scenery. It is situated near the town of Killarney, at the northern side of the range of mountains of which the Reeks form the summit, and consists of three lakes, named the Lower, Turk, and Upper. The first and second are separated only by a narrow isthmus, on which the fine ruin of Mucruss Abbey stands. The third is situated three miles higher in the mountains, and is connected with the others by a river navigable by boats, and equally admired as the lakes themselves for the scenery of its banks. The lower lake is studded with several islands, of which the most remarkable, both for fertility and beauty, is Innisfallen, on which stand the ruins of an abbey of the same name. The island also gives name to one of the most ancient of the native chronicles, entitled the *Annals of Innisfallen.* On Ross Island are the ruins of Ross Castle, which made a gallant stand against the parliamentary forces in the wars of 1641. Another is named O'Donoghoe's Prison, from being supposed to have been used as a place of confinement by a chieftain of that name. The other more remarkable features of the Lower Lake are O'Sullivan's Cascade, and the Bay of Glena, where there is an extraordinary echo. Turk Lake has but one island, named the Devil's Island. The Upper Lake has several. The most remarkable are, Oak, Arbutus, Ronar's, and Eagle Islands. The Lower Lake is not more than fifty feet above the level of the sea. The other lakes in the county are Lough Carrane, near Ballinskelig's Bay, containing several islands; Loughs Derriana and Elaineane, in the mountains of Iveragh; and Lough Brien, Carra, and Gutane, in Dunkerron. The Devil's Punch-Bowl is a small but very deep lake, near the summit of Mangerton Mountain; its water is extremely cold. Lough Quintan, near Kilmacaloge Harbour, has some small floating islands in it.

The coast is indented by several large bays. That next the county of Cork is the estuary of the Kenmare River, which contains some good harbours, and has a number of small islands along its shores. The next is Ballinskelig's Bay, to the north of which are the Skelig Islands. On the largest of these there was a convent, which was afterwards transferred to the mainland. The gannet breeds here, and nowhere else on the coast. North of this bay is Valentia Island, separated from the mainland by a safe and capacious roadstead, which has been chosen as the termination of a proposed railway from Dublin across Ireland, for facilitating the communication with North America. Dingle Bay succeeds, containing within it Castlemaine and Dingle Harbours, and having the Blasquet Islands at its northern extremity. Dunmore Head, to the north-west of this bay, is the most western point of Ireland. Smerwick Bay, Brandon Bay, and Tralee Bay are adapted for smaller vessels only; between the two latter are the Magharees or Seven Hogs Islands. Ballyheige Bay is separated from the Shannon by the bold promontory of Kerry Head. Within the mouth of the Shannon are the harbours of Ballylongford and Tarbert, the latter protected by the island of the same name.

The climate is mild, but moist. Many plants, generally deemed suitable only for the genial atmosphere of more southern latitudes, grow here freely; and cattle remain frequently in the open air during the whole winter. The soil in the northern parts is retentive and coarse; the middle district is mostly of an alluvial character. The valley of the river Mang is entirely limestone. The uplands are chiefly argillaceous, but with limestone intermixed. The valleys in the mountainous region of the south are mostly covered with bog; and, though at present little better than wastes, they are capable, from their favourable exposure, of being cultivated to advantage. All the limestone in the county is secondary, with marine remains and calc spar. The north-western coast to Kerry Head is composed of beds of argillaceous sandstone, nearly horizontal, in the partings of which, the quartz crystals called Kerrystones are found. The midland district is mostly argillaceous, composed chiefly of slate clay and hard sandstone, covering beds of anthracolite and culm, which has not been raised for fuel, partly on account of the abundance of turf, partly from the offensive vapour of the coal when ignited. The component rock of the mountains which form the whole of the southern district is of the transition class, being a clay slate or ardesia. The slate is quarried for roofing, particularly at Valentia Island. It is light and durable, splits readily, bears piercing, and is harder and more siliceous than that of Bangor. In all the mountains the common gritstone contains large quantities of spar or crystal. Detached blocks of it are also found in the valleys, in some places in such quantity as seriously to impede cultivation. Iron ore is found in great plenty in the southern parts, and was largely manufactured at Killarney and Blackstones, until the works were stopped by the failure of timber for fuel. Copper was raised at Mucruss and Ardfert. The marble of Tralee is marked like that of Kilkenny, but with larger spots; other kinds of marble have been raised in various parts. Fine amethysts have been found near Kerry Head. Potters' and pipe clay, a substance like tripoli, brown ochre, and fuller's earth, are to be met with in various places. The whetstones found near the Devil's Punch-Bowl are much valued. Fossil shells, particularly of the cockle species, are frequent. Several mineral springs, some chalybeate, others sulphuro-chalybeate, have been discovered. Of the former, there is one near Killarney, another near Valentia Island, another at the mouth of the Inny, and several between Blackstones and Killorglin. Of the latter, the most celebrated are near Dingle, Castlemaine, and Tralee. A saline spring at Magherybeg, in Corkaguiney, rises a little below high-water mark, bursting out of a clear white sand.

The deep and extensive vales with which the mountainous district in the south is everywhere indented, are almost wholly occupied with bog, most of which, from its elevated position, and the declivities of the land, would admit of easy and profitable reclamation. The extent of bog throughout the county is estimated at 171,054 acres. One species of it, called by the people meagh-bone, or fat turf, is of a highly inflammable quality, and is therefore used more to give light than heat: a small piece applied to a lighted candle burns like a wax taper. The county was once covered with timber, much of which has been cut down for the supply of the iron-works; but there are still many fine tracts of wood; and, even where the land has been cleared, its re-growth is prevented solely by the cattle; for, wherever these are excluded, the trees shoot up from the old roots so vigorously as often to choke up the young plantations. Some of the great landed proprietors are very attentive to the rearing of timber trees.

The population of the county, according to the estimate of De Burgo, amounted to 56,628 in 1760; in 1792, Beaufort judged it to amount to 107,000. The first parliamentary census, taken in 1813, which, however, was very inaccurate, stated it at 178,622; that of 1821, the most correct of any, gives 216,185; that of 1831, 264,559. The census of 1834 being returned according to dioceses instead of counties, prevents the specification of the amount of the population at that period; but from that return it appears that the dioceses of Ardfert and Aghadoe, which are nearly commensurate with the county, contained 304,687 souls, of whom 7529 were Protestants of the established church, twenty-seven Protestant dissenters, and 297,131 Roman Catholics.

The returns of inquiries relative to education present the following results:—

	Boys.	Girls.	Sex unascertained.	Total.
1821,	10,106	3532	...	13,638
1824–26,	14,406	5609	76	20,091

Of the number specified in the second of these returns, 1026 were of the established church, 19,055 Roman Catholics, ten whose religious persuasion was unascertained. The total number of schools was 354, of which twenty-six, containing 1062 pupils, were supported by grants of public money; twenty-nine, containing 2766 pupils, by voluntary contributions of societies or individuals; the remaining 299, containing 16,263 pupils, were wholly supported by the fees of the parents and friends of the children who had recourse to them for instruction.

The relative numbers of Protestant and Roman Catholic children at the schools at the latter period were 1026 and 19,065; of which numbers, 16,263 paid for their education, 2766 were educated by voluntary subscriptions, and only 1062 derived the means of education from the grants of public money. This county was formerly famous for the knowledge of the Latin language acquired by the peasantry. The same holds good to the present day, though in an inferior degree. A taste for mathematics and arithmetic also prevails.

Previously to the union, the county returned eight members to parliament; two for the county, and two for each of the boroughs of Tralee, Dingle, and Ardfert. By the union the number was reduced to three, two for the county, and one for Tralee; and the reform act has made no change in this arrangement. The number of magistrates is 126, of whom fifteen are clergymen. The preservation of the peace is in the charge of the constabulary, consisting of six chief constables, thirty-two constables, and ninety-six sub-constables, making a total of 128 individuals.

The state of the constituency before and after the reform act is as follows:—

Date.	L.100.	L.50.	L.20.	L.10.	40s.	Total.
1st Jan. 1829,	88	460	269	...	3776	4593
1st Jan. 1830,	88	476	334	126	...	1024
1st May 1832,	...	277	231	653	...	1161

Tillage is in a more backward state than in any other part of Ireland, no regular system being practised. The usual crops are, potatoes, wheat, barley, oats, and flax; green crops are little known; rape is cultivated in a few places, for the seed. Dairies are numerous, particularly in the northern parts. The management of the cattle, and the manufacture of the butter, are judicious. An hundred thousand firkins of butter are annually sent to Cork for sale. Lime is much used for manure, as is also sea-sand, one species of which, called floating sand, from its great lightness, and found to consist wholly of fragments of shell, is much prized. In the mountainous parts the plough is little used, the tillage being chiefly executed by a long narrow-bladed spade, called a loy.

Kerry was remarkable for a small breed of black cattle and of horses. But both have degenerated so far as to be nearly extinct, in consequence of the introduction of English breeds. The native Kerry cow was prized for the beauty of its shape, the quantity of its milk, the facility with which it was fattened, and the excellence of its beef. The ponies were formerly found to be strong enough for agricultural purposes, but are now so degenerate as to be unfit for any thing but light saddle weights. Numbers of them, which never felt the restraint of a halter until transferred to the purchaser, are annually driven down from the mountains to the fairs held in the northern district. The Suffolk punch is now the favourite breed amongst the farmers. The sheep are of the mountain kind, in some parts of large size, and in general carrying good clothing wool. They have a strong resemblance to the Spanish merinos, from which they are supposed to be descended.

The chief manufacture is that of coarse linen, which is mostly confined to the barony of Corkaguiney. A quality of narrow cloth, of strong texture, called bandle linen, and also " box and trap," was in great demand for the army and the West India market. It owed its reputation to the careful method of preparing the yarn, but has latterly fallen into disrepute from mismanagement. The manufacture of wool is almost entirely confined to that employed in the domestic consumption, the rest being sent in the raw state to the Cork and Limerick markets. Flannels, however, are sold in some quantities in the markets of Tralee and Dingle. There are some distilleries, and several breweries, in the northern part of the county.

The fishery is chiefly carried on at Dingle and Valentia, from the former in row-boats, and from the latter in sailing vessels. A fishery is also carried on along the shores of the Kenmare River. All kinds of round fish are taken, as are also herrings. Pilchards were caught in large quantities, but they have latterly deserted the coast. Shell-fish of every kind are large and abundant. Salmon is caught in the rivers; but in some places the numbers are considerably diminished by the seals which frequent the rocky shores. These are sometimes shot while basking on the cliffs; at other times they are taken by moonlight in the caves, whither they retire to sleep. This latter mode of capture is attended with danger, as these animals fight desperately with their teeth, when driven to extremity, particularly when their cubs are in danger.

The state of the peasantry varies greatly in the different parts of the county. In the mountainous districts they are comfortable; and, though poorly housed, are well clothed, and enjoy an abundance of fuel. In some parts, the women wear a very becoming dress, consisting of a jacket of crimson or scarlet cloth, with long loose sleeves, made to fit very close round the neck and bosom, and fastened in front with a row of buttons. Marriages are contracted at a very early age; young men are often husbands at eighteen, and young women wives much sooner. In other districts the cattle and pigs are housed under the same roof with the family; the bedding is straw, hay, or dry rushes, with a blanket or coverlet, the floors of the cabins being mostly beneath the level of the soil, with no aperture but the door to let in the light or give vent to the smoke; the clothing is poor and scanty, two thirds of the population being without shoes or stockings; the diet, potatoes and sour-milk. The wages in spring and harvest are tenpence a-day, at other seasons there is no employment. Labourers have been known to offer their day's employment for twopence. In stature, the men are generally tall and well-proportioned, with swarthy complexions, dark eyes, and long black hair, exhibiting marked traces of their Spanish origin. They are a frank, honest race, of independent spirit, acute understanding, and of a friendly, hospitable disposition to strangers.

Remains of antiquity are numerous and singular. The most remarkable, as being unique, is a circular building on the mountains, on the north side of Kenmare River, called Staigue Fort. It surrounds an enclosure about eighty-eight feet in diameter. The wall is about ten feet high, built entirely of dry stone, without mortar, yet so smooth and compact on the outside as to have defied the ravages of time. On the inside it is built in the form of steps, so as to resemble a kind of amphitheatre. The entrance is by a small door, looking directly southwards. Nothing certain is known as to the origin or purpose of this singular erection. Among other conjectures, the most prevalent is, that it was devoted to religious exhibitions. A late ingenious inquirer supposes, from the position of the door, that it had been an observatory. The remains of three pillar towers still exist. One at Ardfert fell in 1771; of the second, at Aghadoe, about twenty feet remain standing; the third and most perfect is at Rattoo. The ruins of monastic institutions are numerous. The most celebrated is Mucruss Abbey, on the peninsula which divides the two lower lakes of Killarney: it is one of the great objects of interest to visitors of that place. In the cloisters, which are surrounded by a colonnade, in two different styles of Gothic architecture, is a venerable yew tree, that throws its branches over the whole interior. Ballinskelig Monastery stood originally on the largest of the islands of the same name, but was afterwards removed to a site on the adjoining mainland: it is in yearly danger of being washed away by the sea. O'Dorney Abbey, near the river Brick, is now a shapeless ruin. Rattoo is said to have been once the site of seven churches, and of a commandery of knights of St John, and also to have been a borough town. There was a dominican monastery at Tralee; but no traces of it now remain. The ruins of several stone cells, supposed to have been the residence of anchorites, still exist. There are many remains of ancient castles. Among the most remarkable are those of Carrigafoyle, Dunlo, Ballyheige, and Ardea, commanding an extensive view of Kenmare River, and once the residence of the O'Sullivans; Dunkerron, another seat of the same family; and Innisfallen, on the island of the same name. This last was taken by General Ludlow during the wars of 1641. A singular dyke, called Clee Ruagh, or the Red Ditch, proceeds from Kerry Head to the Cashin River, and thence to Limerick county, where its traces are no longer visible; it is supposed to have formed the boundary line between the principalities of Thomond and Desmond.

Tralee, the assize town, and the largest in the county, was once the chief residence of the Earls of Desmond, and the place where they held their palatine court. On the ruin of that family, it was made the county town, and obtained a charter, with the right of returning two members to parliament, which it retained till the union, when it was deprived of one of its members. Previously to that period, the constituency was limited to the burgesses, fifteen in number, who were nominated by the proprietor of the town, Sir Edward Denny. It now consists of 180 burgesses and householders. The town suffered greatly in the civil wars of 1641 and 1688. Its situation is healthy and picturesque, but not well adapted for trade, as large vessels can approach no nearer than the Samphire Islands, two miles distant. The court-house and jail form one side of a square in the centre of the town. The other public buildings are, the church, which is a fine modern structure, the Roman Catholic chapel, the Methodist and Independent meeting-houses, the county infirmary, the dispensary, and an infantry barrack for six hundred men. The remains of one of the four castles belonging to the Desmond family are still in existence. At some distance from the town is a celebrated sulphuro-chalybeate spa. The population in 1832 amounted to 9562. The next town in rank and population is Killarney, which owes its celebrity chiefly to the lakes in its neighbourhood; and there were, till lately, extensive iron mines wrought here. Mennius states, that there were four circles of mines round this town; tin, lead, copper, and iron. Tin has not been found here in modern times. Lord Kenmare's seat is contiguous to the town. Its population is 4710. Dingle, a place of some trade, and a fishing station, contains 4357 inhabitants. The population of the other towns which have more than one thousand inhabitants each is as follows: Listowel, 2289; Castleisland, once the county town, but now a declining village, 1569; Milltown, 1427; Ballylongford, a rising sea-port on the Shannon, with a very improveable harbour, 1300; Cahirsiveen, 1192; and Kenmare, at the head of the estuary of the same name, 1072.

KERSEY, a kind of coarse woollen cloth, made chiefly in Kent and Devonshire.

KESCH, or KECH, a town, and capital of a district, in Great Buckharia. It was a favourite city of Timur, whose first appointment was as governor of this place. He here erected a splendid palace, on which the traveller Clavijo found workmen employed who had been labouring here for thirty years. It contained a university for the study of law and the sciences, and had also annexed to it gardens and meadows. It is thirty miles south of Samarcand.

KESITAH. This word is to be met with in Genesis and in Job, and is translated in the Septuagint and Vulgate, sheep or lambs. But the rabbin and modern interpreters are generally of opinion that *kesitah* signifies a piece of money. Bochart and Eugubinus conceive that the Septuagint meant *minæ*, and not lambs; in Greek, *hecatomnon*, ἑκατομνων, instead of ἑκατον ἀμνων. Now a mina was worth sixty Hebrew shekels, and consequently equal to L.6. 16s. 10½d. sterling. Pelletier is of opinion that *kesitah* was a Persian coin, stamped on one side with an archer (*kesitah*, or *keseth*, in Hebrew, signifying a bow), and on the other with a lamb; and that this was a gold coin, known in the East by the name of *daric*. Several learned men, without mentioning the value of the *kesitah*, say it was a silver coin, the impression on which was a sheep, for which reason the Septuagint and Vulgate translate it by this name. Calmet is of opinion that *kesitah* was a purse of gold or silver; and in the East they reckon at present by purses. The word *kista*, in Chaldee, signifies a measure, a vessel; and Eustathius says that kista is a Persian measure. Jonathan, and the Targum of Jerusalem, translate *kesitah* a pearl (Gen. xxxiii. 19; Job. xlii. 11), or L.9 English, supposing, as Dr Prideaux does, that a shekel is worth 3s. A daric is a piece of gold, which, according to Dr Prideaux, is worth 25s. of English money.

KESMARK, a city of the Austrian kingdom of Hungary, in the province of the Hither Theiss. It stands on the river Poprad, at the foot of the Carpathian Mountains. It contains 4650 inhabitants, of whom the majority adhere to the Lutheran church. It is adorned by an elegant palace, has one protestant and two catholic churches, and a Lutheran lyceum, with four professors. There are manufactures of linens and flannels, and considerable trade in wine. Long. 20. 22. E. Lat. 40. 73. N.

KESTREL, the English name for a hawk, called also the *stannel* and the *windhover*, and sometimes the *tinninculus* and *chencris*. It builds in hollow oaks, and feeds on partridges and other birds.

KESWICK, a market-town of the county of Cumberland, in the parish of Crossthwaite, in Allerdale ward. It stands in a deep valley, on the celebrated lake of the same name, or, as it is sometimes called, the Derwent Water. It consists of a single narrow, long street, with no attractive objects. It is protected from the cold winds of the north by the lofty mountain of Skiddaw, which rises to the height of nearly 3000 feet. In the summer it is visited by numerous parties, who make it their head-quarters whilst enjoying the scenery of the lakes and mountains in its vicinity. Keswick is a place of little trade, but there is a market held on Saturday. The inhabitants amounted in 1801 to 1350, in 1811 to 1683, in 1821 to 1901, and in 1831 to 2159.

KESZTHELY, a large and pleasantly-situated town of the Austrian kingdom of Hungary, in the circle of Szante, and province of the Farther Danube. It stands on the lake of Platte. There is in it a fine palace belonging to the family of the Counts Festitics. It has a large Franciscan convent, a hospital, two churches, and 4650 inhabitants, mostly Catholics. There is a valuable institution established by the count for increasing the knowledge and improving the practice of agriculture; and there are seminaries of other descriptions for the purposes of education. Long. 17. 9. 8. E. Lat. 46. 45. 45. N.

KETCH, a vessel equipped with two masts, namely, a main-mast and mizen-mast, and usually from 100 to 250 tons burden. They are principally used as yachts, or as bomb-vessels.

KETCH-HISSAR, a town of Asia Minor, in Caramania, beautifully situated amidst plantations of fruit-trees. It contains many ancient ruins, which extend over a space of seven or eight miles. There is particularly in this place a beautiful aqueduct of granite; and the massy foundations of several large edifices are to be seen in different parts of the town; and shafts, pillars, and pedestals lie buried under ground. It is supposed by Mr Kinneir that this place is the ancient Tyana, described by Strabo as one of the oldest cities in Cappadocia. The whole neighbourhood is impregnated with nitre, which supplies materials for a large manufactory of gunpowder. It is eighty-five miles south-west of Kaisarieh.

KETCHLUK, a town of Asia Minor, in Caramania, surrounded with gardens, and supposed to be the city described by Xenophon, in the plain of Cayster, where Cyrus first met the queen of Cilicia. It is ninety-eight miles north-west of Konieh.

KETEE, a town of Hindustan, in the province of Sinde. It is situated on an island in the river Indus, and is the principal town of a Mahommedan chief named Meer Thara.

KETOIE, one of the Kurile Islands, near the eastern coast of Asia, about twenty miles long and seven broad. It is covered with wood, which affords shelter to white foxes, seals, and sea-calves.

KETTERING, a town of the hundred of Orlingbury, in the county of Northampton, with a market on Saturday. It is seventy-five miles from London, and is a manufacturing place, where some worsted and woollen goods are made. It is not a well-built town. The sessions for the county are held in it. The inhabitants amounted in 1801 to 3011, in 1811 to 3242, in 1821 to 3668, and in 1831 to 4099.

KETTLE, in the art of war, a term which the Dutch apply to a battery of mortars, because it is sunk under ground.

Kettle-Drums are formed of two large basins of copper or brass, rounded at the bottom, and covered over with vellum or goat-skin, which is kept fast by a circle of iron, and by several holes fastened to the body of the drum, with a like number of screws to screw up and down, and a key for the purpose. The two basins are kept fast together by two straps of leather which go through two rings, and are fastened the one before and the other behind the pommel of the kettle-drum's saddle. They have each a banner of silk or damask, richly embroidered with the sovereign's arms, or with those of the colonel, and are fringed with silver or gold; and, to preserve them in bad weather, they have each a cover of leather. The drumsticks are of crab-tree or of any other hard wood, of eight or nine inches long, with two knobs on the ends, which beat the drum head and produce the sound. The kettle-drum with trumpets is the most martial sound of any. Each regiment of horse has a pair.

Kettle-Drummer, a man on horseback appointed to beat the kettle-drum, from which he takes his name. He marches always at the head of the squadron, and his post is on the right when the squadron is drawn up.

KEVELS, in *Ship-building*, a frame composed of two pieces of timber, whose lower ends rest in a sort of step or foot nailed to the ship's side, whence the upper ends branch outward into arms or horns, serving to belay the great ropes by which the bottoms of the main-sail and fore-sail are extended.

KEVERN, St, a parish of the hundred of Kerriar, in the county of Cornwall, 277 miles from London. The inhabitants amounted in 1801 to 2104, in 1811 to 2242, in 1821 to 2505, and in 1831 to 2437.

KEW, a village of the hundred of Kingston, in the county of Surrey, six and a half miles from London, on the right bank of the Thames, over which there is a handsome bridge. It is a pleasant village, with many highly respectable houses, but chiefly distinguished for the royal palace, the favourite residence of George III. The palace is of modern construction, built of brick faced with stone in the Gothic style. It is, however, inferior to the gardens, which are laid out with taste and judgment, and contain almost every curious vegetable production of various countries and climates. There are in these gardens a variety of temples connected with classical and historical subjects. One of the most remarkable is the Chinese pagoda, about 170 feet in height, said to be an exact copy of one in the celestial empire, from the top of which is a fine prospect over the surrounding country. The population amounted in 1801 to 424, in 1811 to 560, in 1821 to 683, and in 1831 to 837.

KEY, an instrument for the opening of locks. Molinus, in his treatise of keys, *De clavibus veterum*, printed at Upsal, derives the Latin name *clavis* from the Greek κλειω, *claudo*, I shut, or from the adverb *clam*, privately; and adds, that the use of keys is yet unknown in some parts of Sweden. The invention of keys is due to one Theodore of Samos, according to Pliny and Polydore Virgil; but this must be a mistake, as the use of keys was known before the siege of Troy, whilst mention is even made of them in the nineteenth chapter of Genesis. Molinus is of opinion that keys at first served only for untying certain knots wherewith they anciently secured their doors; but the Laconic keys, he maintains, were nearly akin in use to our own, consisting of three single teeth, and made in the figure of an E; a form of which there are still some to be seen in the cabinets of the curious. There was another key called βαλαναγρα, made in the manner of a male screw, which had its corresponding female in a bolt affixed to the door. *Key* has hence become a general name for several things serving to shut up or close others.

Key, or *Key-stone, of an Arch or Vault*, is the last stone placed on the top thereof, which, being wider and fuller at the top than bottom, wedges, as it were, and binds together all the rest. The key is different in the different orders. In the Tuscan and Doric it is only a plain stone projecting; in the Ionic it is cut and waved, somewhat after the manner of consoles; in the Corinthian and Composite it is a console enriched with sculpture, foliages, and other ornaments.

Key is also used for ecclesiastical jurisdiction, particularly for the power of excommunicating and absolving. The Romanists say the pope has the power of the keys, and can open and shut paradise as he pleases, grounding their opinion on that expression of Jesus Christ to St Peter, "I will give thee the keys of the kingdom of heaven." In St Gregory we read that it was the custom for the popes to send a golden key to princes, in which they enclosed a little of the filings of St Peter's chains, kept with a world of devotion at Rome; and that these keys were worn in the bosom, as being supposed to contain some wonderful virtues.

Key, in *Music*, a certain fundamental note or tone, to which the whole piece, be it in cantata, sonata, or concerto, is accommodated, and with which it usually begins, but always ends.

Key, or *Quay*, a long wharf, usually built of stone, by the side of a harbour or river, and having several storehouses for the convenience of lading and discharging merchant ships. It is accordingly furnished with posts and rings, by which the latter are secured; together with cranes, capstans, and other engines, to lift the goods into or out of the vessels which lie alongside. The verb *cojare*, in old writers, according to Scaliger, signifies to *keep in* or *restrain*; and hence came our term *key* or *quay*, the ground where they are made being bound in with planks and posts.

KEY'S Isles, three islands in the Eastern Seas, of considerable extent, and named Key Watela, Little and Great Key Islands, the first forty-five and the second sixty miles in circumference, and the third fifty miles in length and from five to twelve in breadth. They are situated about the 133d degree of east longitude and between the 5th and 6th degrees of north latitude.

KEYDEE, a town of Hindustan, in the province of Bahar, district of Nagpoor, 235 miles west by north from Calcutta. Long. 84. 49. E. Lat. 22. 46. N.

KEYNSHAM, a market-town in the hundred of the same name, in the county of Somerset, 114 miles from London. It is situated on the south bank of the river Avon, midway between Bath and Bristol. There is little trade, but a small market on Thursday. The inhabitants amounted in 1801 to 1591, in 1811 to 1748, in 1821 to 1761, and in 1831 to 2142.

KEYSLER, John George, a learned German antiquary, was born at Thournex in the year 1689. After studying at the university of Halle, he was appointed preceptor to Charles Maximilian and Christian Charles, the young counts of Giech-Buchau, with whom he travelled through the chief cities of Germany, France, and the Netherlands, gaining great reputation amongst the learned as he went along, by illustrating several monuments of antiquity, particularly some fragments of Celtic idols discovered in the cathedral of Paris. Having acquitted himself of this charge with great honour, he was, in 1716, appointed to superintend the education of two grandsons of Baron Bernstorff, first minister of state to his Britannic majesty as elector of Brunswick-Lunenburg. However, having in 1718 obtained leave to visit England, he was elected a fellow of the Royal Society, for a learned essay *de Dea Nehelennia, numine veterum Walachorum topico*. He also gave an explanation of the ancient monument on Salisbury Plain called Stonehenge, with a dissertation on the consecrated misletoe of the Druids. These detached essays, with others of the same kind, he published on his return to Hanover, under the title of *Antiquitates selectæ Septentrionales et Celticæ*. He afterwards made the grand tour with the young barons, and to this we owe the publication of his travels, which were translated into English, and published in 1756, in four vols. 4to. Mr Keysler, on his return, spent the remainder of his life under the patronage of his noble pupils, who committed their fine library and museum to his care, with a handsome income. He died in 1743.

KHANAKEE, a handsome little town of Irak Arabi, on the high road from Bagdad to Hamadan. In the vicinity are some magnificent ruins, supposed to be those of the palace of Chosroes. It is ninety miles north-east of Bagdad.

KHANDESH, a province of Hindustan, in the Deccan, situated between the 21st and 23d degrees of north latitude. To the north it is bounded by the Nerbuddah, which separates it from Malwah; to the south by Aurungabad and Berar; on the east by Gundwana and Berar; and on the west by Gujerat. Its limits have never been accurately defined, though they may be estimated at 210 miles in length by eighty in average breadth. Khandesh was one of the small soubahs formed during the reign of Akbar, from conquests made south of the Nerbuddah. The modern subdivisions are, 1. Gaulna; 2. Khandesh proper; 3. Meiwar; 4. Bejagur; 5. Pattnemaur; 6. Hindia. This province is remarkably strong by nature, containing, within one day's march, nearly twenty fortresses, all in sight in different directions. The country is well watered. The chief rivers are, the Nerbuddah, Tuptee, and other tributary streams; the principal towns, Boorhanpoor, Asecrghur, Hindia, Nundoorbar, and Gaulna. The surface of the province is very irregular, though it is not mountainous. The ridge of the western Ghauts extends along the Tuptee, from which passes descend into the lower country. This river has deep and steep banks, and the adjacent country is curiously intersected with ravines from thirty to forty feet deep, and sometimes winding along for a distance of several miles. As the road frequently leads through these chasms, which are remarkably close and hot, it is not uncommon to see an army on its march through the country disappear in these deep valleys, and afterwards emerge half suffocated with heat and covered with dust. This country was once flourishing and populous; but at present, owing to the devastations of different plundering tribes, such as the Bheels, Pindarrics, and Arabs, joined to the oppressions of its Mahratta rulers, it is now desolate and overgrown with jungle, the towns are in ruins, the villages have been destroyed, and the soil, though fertile and well watered, lies neglected. The population is estimated at two millions, five sixths of whom are Hindus.

Khandesh was governed in the beginning of the fifteenth century by independent sovereigns, who, claiming descent from the Khalif Omar, resided at Aseerghur; but, towards the close of the century, it was subdued, and annexed to the Mogul empire. Since the decline of the Mahratta power, the greater part of the province of Khandesh was taken possession of by Arab colonists, whose soldier-like qualities gave them great influence in India. In 1818 the whole of Holkar's territories in India were ceded to the British, to whose dominion the Arab colonists evinced a decided aversion; and as it was resolved to re-transport them to their own country, they determined to resist to the last extremity. The last body of these brave adventurers surrendered in December 1818; but many of the Bheel chiefs, trusting to their mountainous and jungly recesses, continued refractory. They were dislodged from many of their retreats by the vigilance of British officers, who were for a long time engaged in this harassing warfare. The province was formerly famous for the manufacture of cotton cloths called baftahs.

KHARKOW, or CHARKOW, a city of the province Ukraine, in Russia, the capital of a circle of the same name. It is situated on the Donez, where that river receives the waters of the Lepanka and the Charkow. It contains 1552 houses, and 15,000 inhabitants. It is the seat of a university founded in 1813, with twenty-five professors, and 250 students. It enjoys some considerable trade, especially at four great fairs, to which the Asiatics and Turks equally resort. Long. 36. 50. 55. E. Lat. 49. 59. 20. N.

KHARSHOOT, a river of Asiatic Turkey, which, flowing through a narrow and beautiful valley, falls into the Black Sea near Tereboli.

KHASGUNGE, a town of Hindustan, in the province of Agra, sixty-four miles north-west from the town of Furruckabad. Long. 78. 36. E. Lat. 27. 52. N.

KHATANGA, a considerable river of Siberia, which has its rise in the government of Tomsk, and, after a course of 500 miles through a low and marshy territory, falls into the Northern Ocean, forming a gulf to which it gives name.

KHAUAR, or HAWARI, a town of Irak, in Persia, 200 miles north of Ispahan. It is situated on a mountain which separates the province of Irak from that of Mazanderan, and through which there is a narrow pass that takes its name from the town.

KHEMLASA, a large walled town of Hindustan, with a fort adjoining, in the province of Malwah, ninety-four miles south-west from Chatterpoor. Long. 78. 36. E. Lat. 24. 15. N.

KHEROO, a town of Thibet, situated on the north of the great Himalaya ridge of mountains, formerly a large, but now an inconsiderable place, having been laid waste, prior to 1790, by an incursion of the Tartars, who occupy the country to the north of Joongale. A considerable trade is carried on between Nepaul and this place.

KHILLIS, a town of Syria, situated at the foot of Mount Taurus, where there is a celebrated market for cotton. It is twenty-eight miles north-north-west of Aleppo.

KHOEE, a town of Azerbijan, in Persia, and capital of a rich and extensive district, situated on the borders of the lake Urumea. There is no town in Persia more beautiful and better built; the walls are in good repair; the streets regular, and shaded with avenues of trees; and the ceilings of many of the houses tastefully painted and embellished. These paintings are not modern; and as the immediate predecessors of Shah Ismael frequently held their court in this city, they were probably executed about that period. It is the emporium of a considerable trade carried on between Turkey and Persia. The population amounts to 25,000. The plain in which it is situated is famous for a battle fought in 1514, between Shah Ismael and Selim I., in which 30,000 Persians encountered 300,000 Turks.

KHOOSHGAL, a well-built small fort in the province of Bejapoor, and district of Bancapoor, strongly situated on a rising ground in the middle of an extensive plain. Long. 75. 13. E. Lat. 15. 29. N.

KHORASSAN is, strictly speaking, a province of Persia. In its more extended sense, however, it comprehends

Khorassan. an extensive tract of country, of which the boundaries have been differently defined, and indeed have greatly varied. In the great revolutions which have occurred in Asia, Khorassan has been the centre of a great empire, and the seat of mighty monarchs, and more frequently the dependency of a fallen state, and the scene of invasion, rebellion, and anarchy. It was a constant subject of dispute between the independent monarchs, whose territories lay respectively on the east and on the west; and it sometimes fell into the power of one, and sometimes of the other. In these circumstances, its political boundaries were continually varying, as the fortune of war inclined to one or other of the surrounding potentates. At one time they comprehended the whole country to the mouth of the Oxus, including the steppe of Khaurezm, Balkh, and all the intervening country to the east; on the south-east, not only the cities and dependencies of Herat, but those of Subzawur, Furrah, Geeresh, and even Candahar itself; on the south it was always bounded by Kerman and Seistan; on the west it included the district of Yezed, but its salt desert was bounded in that direction by the districts of Ispahan, Cashan, and Rhe, in the vicinity of Semnaun; and beyond the Elburz Mountains, the districts of Astrabad and of Goorgaun were also considered as the dependencies of this vast territory. If Khorassan be merely considered as a province of Persia, its extent would be very inconsiderable indeed. But if, with Fraser, we take into consideration the natural features of the country, the following boundaries may be assigned. According to this traveller, a line, skirting the districts of Ispahan and Cashan, and meeting the Elburz Mountains near Dehnimmuck, will divide Khorassan from Irak on the west. This line prolonged eastward to the desert on the eastern side of the Caspian Sea, in the steppe of Khaurezm, will form its northern boundary; and we cannot positively decide, nor is exactness in this matter of great importance, in what part of the great desert that occupies the whole space between the foot of the Elburz range and the Oxus, this boundary should be placed. In a political view, it does not extend at present beyond the base of the Elburz Mountains. To the eastward it may properly be allowed to include the districts of Serrukhs, Hazarah, and Balai Moorghaub; and a line running between these and the dependencies of Balkh, in east longitude 63°, in a direction nearly south, including the district of Herat, and touching Seistan, would be the boundary of Khorassan on the east; whilst on the south it is bounded by Kerman and Fars.

The surface of this extensive country is, like other parts of Persia, much diversified by plains and mountains; a very large proportion is quite unfit for the habitation of man, and consists of arid rocks, destitute of vegetation or fresh water, and deserts either of salt-land or sand, among which may be found a few spots, like islands in the sea. The following is a more particular description, chiefly compiled from Fraser's *Narrative of a Journey into Khorassan*.

The Elburz range of mountains, which is connected with the great chain of Caucasus, runs, in an easterly course, through the northern parts of Khorassan, sending forth various ramifications to the southward. From the base of these mountains a desert of barren sand, chiefly level, stretches northward to an immense extent, including the steppe of Khaurezm, and forming a part of that mighty plain which extends eastward as far as the Jaxartes and the Oxus. In this plain are found many fertile districts; but in that portion which is included in the limits now assigned to Khorassan, there is no permanent habitation, and the scanty sprinkling of population which it possesses consists of a few tribes of wandering Toorkomans. These mountains, though they present their loftiest face to the desert, still sweep down in a manner so gradual, as to enclose rich and well-watered valleys, which were formerly well peopled and cultivated, and once contained several towns, which are now in ruins, from the continued attacks of the Toorkoman plunderers. The only place of any consideration that remains is Serrukhs, 120 miles from Mushed, a very ancient town, the remains of which are now inhabited by Toorkomans and Usbecks. To the south, the Elburz Mountains send forth ramifications which penetrate the plain to the distance of from sixty to one hundred miles. Beyond this is the vast salt desert, which extends southward, with occasional fertile tracts, very nearly to the Persian Gulf. This desert varies very much in its nature in different parts. In some places the surface is dry, and even produces a few of those plants that thrive in a salt soil; in others it consists of a crackling crust of dry earth, covered with a saline efflorescence. There are extensive marshy tracts, in the lower parts of which water accumulates during the winter months, which is evaporated by the summer sun, leaving a quantity of salt in cakes, upon a bed of mud. In some places the soil is a hard-baked and perfectly barren clay; again, in certain districts, extensive plains of sand are found, which is occasionally heaped up in hillocks in the form of waves, and frequently so light as to be raised aloft by the winds in clouds, under which travellers are frequently buried, as in the Arabian deserts. The saline desert, however, according to Fraser, predominates in Khorassan. It is of a considerably higher level than the desert to the north of the Elburz Mountains; but still this traveller is of opinion that they are connected. The only fertile parts of Khorassan are where the country is penetrated by the Elburz Mountains; and in the north-east corner of Khorassan there is a long stripe of country, consisting of the lower parts of these mountains, from ten to twenty miles in breadth, which bear some inconsiderable traces of cultivation, and give shelter to a few miserable hamlets, but contain no village of any consequence. The valley of Mushed, amongst the Elburz Mountains, is of great length. It commences ten or twelve miles to the north-west of Sheerwan, extends, without interruption, for fifty miles beyond Mushed, and continues for the greater part of the way to Herat. It varies from twelve to thirty miles in breadth, and contains in its extent, besides the city of Mushed, the towns of Chinnaran, Radcan, Kabooshan or Cachoon, Sheerwan, and their dependencies, with a great extent of cultivated land. The road from Mushed to Herat must also pass through several well-peopled and well-cultivated districts. The extensive valley here spoken of contains a considerable portion of the district known by the appellation of Koordistan, being inhabited by Koordish colonies. The country which we have described above, under the title of Khorassan, may be estimated to extend between 500 and 600 miles east and west, and between 300 and 400 miles north and south.

Khozdar ‖ Khyrabad.

KHOZDAR, a town of Beloochistan, the residence of Meer Murad Ali, one of the principal Beloochee ameers of the Kumburanee tribe. It is situated in a small romantic valley of the same name, between two tremendous ridges of bare rocky mountains, tolerably well cultivated, and watered by a stream flowing through the centre. The town is walled, and has a good bazar. It is a Mahommedan town, though the Hindus are held in great esteem. The climate is severe; and at the approach of winter the richer classes retire to Cutch Gundava, to avoid the intense cold of the mountain air. It is distant from Kelat, the chief town of Beloochistan or Baloochistan, three days' journey. Its situation is not exactly ascertained, but is nearly in latitude 36. 30. N. and long. 67. E.

KHYRABAD, or KAIRABAD, a district of Hindustan, in the province of Oude, situated principally between the 27th and 28th degrees of north latitude, and bounded on the west by the Ganges, and on the east by the Goggra. The country is fertile and well watered, being intersected by the river Goomty; and its chief towns are Khyrabad, Shahabad, and Mahomdy. The capital, which is of the same name, is conveniently situated between two streams which fall into the river Goomty. Long. 80. 45. E. Lat. 27. 29. N.

KHYRPOOR, a town of Hindustan, in the province of Sinde, and the residence of the chiefs of the aristocracy who govern the place. It carries on a considerable trade, and is noted for the dyeing of cloths. Latitude not ascertained.

KHYVAH, an independent territory of Asia, which extends on or near the banks of the Oxus a distance of between 100 and 200 miles, and on all quarters is surrounded by the desert. The town of Khyvah, the capital, is about fifteen miles from the Oxus, or 240 miles from Mungushluc, a bay upon the banks of the Caspian Sea. This tract of country, however confined and unpromising, was at one time the seat of the Khaurezmian sovereigns, who maintained a very flourishing empire, well known in the annals of the East. This empire embraced the principal part of Western Asia, and the country around was populous and prosperous. But all is now changed. The country has been ruined by the invasions of different conquerors; and the city of Khaurezm or Ourgunge, like the most celebrated cities of the East, has become a ruin; and the seat of the petty power that now exists has been transferred to the mean and modern town of Khyvah. The modern city of Khyvah was totally ruined by Nadir Shah, at the time when he overran all Turkestan, on his return from India; its youth were enlisted in his armies, a great many were put to death, and numbers were transported to distant parts. The Usbeck Tartars at length obtained the ascendency in this country, and maintained on the throne a prince said to be of the race of Ghenghis. A chief from one of their tribes still rules in the country.

KIAHING FOU, a large and populous town of China, in the province of Tchekiang. It has extensive silk manufactures, there being scarcely a house in which silk-worms are not bred. It carries on a considerable trade, for the convenience of which canals are cut in every street. It is 130 miles south-east of Nanquin. Long. 120. 14. E. Lat. 32. N.

KIAKHTA, a town of Asiatic Russia, in the government of Irkoutsk, and district of Verschnei-Oudinsk. It is situated in a uniform and rather elevated plain, traversed by a river of the same name, and is surrounded by a lofty range of granitic and wooded mountains of a bleak aspect. It was visited in 1822 by Captain Cochrane, the celebrated pedestrian traveller, who mentions that it is a neat and regularly-built town, containing 450 houses, with 4000 inhabitants. Owing to the narrow and jealous policy of the Chinese, no stone buildings are by the treaty allowed to be erected, excepting only a church for public worship. Beyond the fortress, and immediately opposite Maimatchin, is the Chinese town Old Kiakhta, the residence only of the merchants; no officer or stranger being permitted to sleep in it, according to an article in the treaty. The old town contains, according to Cochrane, forty-five dwellings, many of which are very superior edifices, and have within them very rich stores. Though situated in a dreary and sterile oasis, Kiakhta, by means of its commerce, possesses many comforts. It is 330 miles south of Irkoutsk. On one of the mountains by which the place is surrounded are seen the boundaries of the Russian and Chinese empires, placed opposite each other; the Russian boundary being marked by a hillock of stones, with a cross at the top; whilst that of the Chinese is marked by a kind of pyramid. This place is remarkable as the centre of all the trade which is carried on between the Russian and Chinese empires; the Chinese, by the jealous policy of their rulers, being prohibited from trading with Russia through any other place. It was fixed upon by the treaty concluded between these powers in 1728, as the only medium of their mutual intercourse; and a great fair is accordingly held in December, when merchants flock thither from the most distant parts of the Russian empire. At this great commercial rendezvous are exchanged cloths; furs, namely, those of foxes, sables, river and sea otters, wild cats, beavers, and millions of squirrels, this latter fur, from its lightness, warmth, and durability, being a favourite with the Chinese; Russia and Morocco leather; for nankeens, silk stuffs, tea, rhubarb, &c. Woollen cloths and copper money are also exported to China, as well as many articles of curiosity and ingenuity, and some trinkets. The Russian and Chinese towns are quite separate from each other.

KIAMA, or Khiama, the capital of one of the four petty states or sultanries of Borgoo, a kingdom in the interior of Africa. It consists of a vast collection of thatched huts, built, as well as the town wall, of clay, and irregularly scattered over a considerable surface of ground. It is one of the towns through which the Houssa and Bornou caravan passes in its way to Gouja, upon the borders of Ashantee. It has also a direct trade with Dahomey, Youri, Nyfei, and Youriba. The inhabitants, for the most part Pagans, may amount to 30,000 in number. They are governed by a king or sultan, whose domination is despostic. Kiama is situated in long. 5. 22. 56. E. and lat. 9. 37. 33. N.

KIANGNAN, a province of China, which may be considered as the centre of the navigation, wealth, and commerce of this great empire. It is bounded on the east by the sea, on the north by Shantung, on the west by Honan, and on the south by Tchekiang and Quangsee. This extensive province is well watered, being traversed by the great rivers Hoangho and Yang-tse-kiang, previous to their junction with the sea, and by their numerous tributaries, which give it an easy communication with all the provinces and districts of the interior. It is also crossed by the great canal which leads to Pekin; and its waters are accordingly covered with a continuous line of barks, carrying to their various markets the different productions of the country. Nankeen is the capital, which surpasses Pekin in extent, and even in population. It contains many other cities, which, in point of size and wealth, might have been the capitals of empires. Industry and manufactures flourish to a great extent in this province; and the silks, japanned goods, ink, paper, and other articles, bear a higher price. There are manufactories of salt on the sea coast; and it contains also quarries of marble. The official estimate of the population given to Sir George Staunton was twenty-two millions, which is probably one of the boastful exaggerations of the Chinese.

KIANGSEE, a fine province of China, consisting chiefly of lofty and precipitous mountains, with fertile valleys interposed. It extends southwards from Kiangnan to Quangtong, and yields in abundance both rice and silk. Its mountains also contain various metals and minerals, and it has an uninterrupted navigation from north to south, forming part of the great line of water communication which reaches across the empire. A very extensive manufacture of porcelain is carried on in this province.

KIBBAN, a considerable town of Koordistan, situated at the foot of a high mountain, and surrounded by narrow passes and defiles. It is about one and a half mile from the Euphrates, and eighty miles west of Diarbekir.

KIDDER, Richard, an English bishop, was born, according to Wood, at Brighton, but according to others, in Sussex. In 1649, he was admitted sizar in Emmanuel College, Cambridge; in 1652, he took his bachelor's degree; in 1655, he was elected a fellow; and in 1656, he took his degree of master of arts. Having been presented by his college to the vicarage of Stanground, Huntingdonshire, he was ejected for non-conformity in 1662; but conforming soon afterwards, he was, in 1664, presented to the rectory of Raine, in Essex, where he continued until 1674, when he was made rector of St Martin's Outwith, London. In 1681, he was installed into a prebend of Norwich; in 1689, he was made Dean of Peterborough, on which occasion he took the degree of doctor in divinity; and, upon the deprivation of Ken, bishop of Bath and Wells, he was promoted to the vacant see. In 1693, he delivered the Boyle Lecture, and afterwards inserted in his Demonstration of the Messias, the discourses preached by him upon that occasion. He also wrote a Commentary on the Five Books of Moses, with a dissertation concerning the author or writer of the said books, and a general argument to each of them, which was published in 1694, in two vols. 8vo. To the first volume is prefixed a dissertation, in which he states and answers all the objections made against Moses being the author of the Pentateuch, and, in particular, replies to one drawn by Leclerc from Genesis (xxxvi. 31), which he treats with some severity. This led to a correspondence between him and Leclerc, which the latter printed in his *Bibliothèque Choisie*. Dr Kidder likewise took part in the Popish controversy, in the course of which he published, 1. A Second Dialogue between a Catholic Convert and a Protestant, showing why he cannot believe the doctrine of Transubstantiation, though he do firmly believe the doctrine of the Trinity; 2. An Examination of Bellarmine's thirtieth note of the Church on the Confession of Adversaries; 3. The Texts which Papists cite out of the Bible for their Doctrine of the Sacrifice of the Mass examined; 4. Reflections on a French Testament, printed at Bordeaux in 1686, pretended to be translated out of the Latin by the divines of Louvain. The death of this prelate was sudden and lamentable. In the night between the 26th and 27th of November 1703, he was killed in bed, with his lady, in his palace at Wells, by the fall of a stack of chimneys, occasioned by a violent storm which raged without. Dr Kidder was a clear and learned writer, and accounted one of the best divines of his time. (A.)

KIDDERMINSTER, a town of the hundred of Halfshire, in the county of Worcester, with a market, which is held on Thursday. It is 126 miles from London, on the river Stour. It has long been a place of great manufacturing industry. Formerly the chief goods made were of worsted, or of silk and worsted; then bombazeens, plushes, and poplins were introduced; but of late years the chief fabrics have been those of carpets, in which the Kidderminster manufactures have excelled all others. The streets are clean, well paved, and well built. There is a fine old Gothic church, a town-hall, many charitable institutions, and an endowed grammar-school. By the late law this town has acquired the right of electing one member to the House of Commons. The Staffordshire Canal joins the town, and affords assistance to its trade. The inhabitants amounted in 1801 to 6110, in 1811 to 8039, in 1821 to 10,709, and in 1831 to 14,981.

KIDDLE, or KIDEL (*Kidellus*), a dam or weir in a river, with a narrow cut in it, for the laying of pots or other engines to catch fish. The word is ancient, for in Magna Charta (cap. 24) we read *Omnes kidelli deponantur per Thamesiam et Medweyam, et per totam Angliam, nisi per costeram maris*; and, by King John's charter, power was granted to the city of London *de kidellis amovendis per Thamesiam et Medweyam*. A survey was ordered to be made of the weirs, mills, stanks, and kiddles, in the great rivers of England, by 1 Hen. IV. Fishermen corruptly call these dams *kettles*; and they are much used in Wales and on the sea-coasts of Kent.

KIDNAPPING, the forcible abduction or stealing away of man, woman, or child, from their own country, and sending them into another. This crime was capital by the Jewish law. "He that stealeth a man and selleth him, or if he be found in his hand, shall surely be put to death." (Exod. xxi. 16.) So likewise, in the civil law, the offence of spiriting away and stealing men and children, which was called *plagium*, and the offenders *plagiarii*, was punished with death.

KIDWELLEY, a market-town of South Wales, in the county of Carmarthen, 226 miles from London. It is built on both sides the river Gwendraeth, which is navigable from Carmarthen Bay. It was formerly surrounded with walls, and there are still the ruins of an ancient castle. The neighbourhood abounds with coals, the export of which forms the principal trade; and for promoting which, excellent mechanical contrivances have been adopted for the most economical mode of trans-shipping them from the barges to the sea-bound vessels. Near the town is an iron foundery, and also a manufactory of tin plates. The town forms part of the duchy of Lancaster, but is governed by its own mayor and aldermen. There is a tolerable market on Friday, and three annual fairs. The population amounted in 1801 to 1488, in 1811 to 1441, in 1821 to 1733, and in 1831 to 1631.

KIEL, a city of Denmark, in the province of Holstein, the capital of a bailiwick of the same name. It stands on a beautiful bay, resembling a lake, on the Baltic, and has an excellent harbour. It contains near 800 houses, with 8000 inhabitants. It is a well-built city, containing a university of high character, with about 250 students, an observatory, a museum of natural history, and a library of 60,000 volumes. It is a place of considerable trade, both in the productions of the vicinity and in foreign commodities, and in ship-building and the fisheries. Long. 10. 4. E. Lat. 54. 16. N.

KIELCE, a city of Poland, in the province of Cracow, the capital of a circle of the same name, and the seat of a bishop. It is, for a country like Poland, a well-built town, with the bishop's palace, four churches, a nunnery, 800 houses, and 5100 inhabitants. Long. 19. 55. E. Lat. 50. 52. N.

KIEW, a province or government of European Russia, in the division formerly called Little Russia. It is situated between 28. 30. and 32. 20. east longitude, and 48. 26. and 51. 34. north latitude. It extends over 15,466 square miles, comprehending sixty-eight cities and towns, and 1304 parishes, with several villages and hamlets in each. The inhabitants are 994,830. It is divided into twelve circles, receiving the name of the chief towns in it. It is generally a level district, with undulations of hills proceeding from the Carpathian Mountains, whose elevations in this province are inconsiderable. There are many pleasant spots, though none very striking; but the whole face of the country has a monotonous appearance. The soil is generally favourable to cultivation, and yields corn more than sufficient for consumption, so as to have 1,000,000 quarters annually for the supply of less productive districts. It yields abundant crops of hemp, flax, and tobacco. The cattle are numerous, and many are sold to Germany, Austria, and the internal provinces, to improve the breed. There are no mines. Much spirit is distilled from grain, which, with coarse cloth, soap, and leather, forms the chief branch of trade. The principal river, the Dnieper, receives the waters of the smaller rivers, and conveys them to the Black Sea. The capital, Kiew, is on the Dnieper, is the seat of an archbishop, and has a cathedral, twenty-five other churches, an ecclesiastical seminary or college, and other public institutions. It contains 3728 houses, in narrow and winding streets, and about 40,000 inhabitants. Long. 30. 22. 25. E. Lat. 50. 26. 19. N.

KILDA, St, or Kirta, a solitary isle in the Atlantic Ocean, belonging to the range of the Hebrides, but removed to a considerable distance from the main cluster. The nearest land to it is Harris, from which it is distant sixty miles in a west-south-west direction; and it is about one hundred and forty miles from the nearest point of the mainland of Scotland. It is about three miles long from east to west, and two miles from north to south, and consists of a lofty and uneven ridge, fenced round on all sides by one continued perpendicular mass of rock, of great height except at a part where is the bay or landing place, and even there the rocks have a considerable elevation. The surface of the island is rocky, rising into four eminences, the highest of which, called Conachan, is 1380 feet above the level of the sea. The general surface of the ground is a black loam, six or eight inches deep, and presents a nearly uniform, smooth, and green surface. Excepting some imperfect peat upon the highest point, the whole is covered by a thick turf of the finest and freshest verdure. The island contains three principal springs, one of which gives rise to a considerable stream. Excepting a small tract in the vicinity of the little village in which the inhabitants live, the whole island is in pasture. The soil would admit of cultivation to any extent, but the violence of the west winds limits the agriculture to the south-east declivity, where there is most shelter. This tract is held conjointly by all the village, on the system of run-rig, the ridges being interchanged after three years; and the work is performed by the spade and hand-plough. The produce consists chiefly of bear, which is considered as very fine. The oats are of very inferior quality, and are scantily cultivated; nor are potatoes raised to nearly the extent which is usual in Highland farming. A few horses are kept, together with some goats; but the pasture is chiefly occupied by sheep and black cattle. The breed of the former is Norwegian, and the wool which these animals produce is both thin and coarse. The cattle are small, and both the ewes and cows are milked. The cheese, which is made from a mixture of these milks, is much esteemed. This article, along with wool and feathers, constitutes the exports of the island. The St Kilda style of husbandry is somewhat primitive and peculiar to the island. The soil is rendered extremely fertile by the laborious industry of the inhabitants, who manure it with great care. The inhabitants are all congregated in a village about a quarter of a mile from the bay on the south-east. It consists of two rows of houses, with a pavement in the middle; and the habitations, like those of oriental countries, are nearly flat in the roof, in order to avoid injury from the storms which sweep over the island. The walls of the cottages are built of coarse free-stone, without lime or mortar, but consolidated by alternate layers of turf. All the houses are divided into two apartments, the interior one being for the family, and the other, nearest the door, being reserved for sheltering the cattle during winter. From their insulated situation, it is probable that the inhabitants of St Kilda have maintained the same manners, customs, and general style of life, for centuries. Previously to the reformation, there appears to have been three religious buildings on the island; but after that event took place, the inhabitants continued for ages unsolaced by the blessings of religion, being only connected with the parish of South Uist by name. These disadvantages are now obviated by the establishment of a missionary and a schoolmaster, under the patronage of the Society for the Propagation of Christian Knowledge. The people live much upon the wild sea-fowl with which the precipices abound; and at certain seasons the whole sea is covered, and the very atmosphere is darkened, with feathered animals. Upwards of 20,000 solan geese are annually consumed by the natives, besides an immense number of eggs. St Kilda contains about twenty families, who, remote from the bustle of the busy world, and the luxuries of polished society, pass an easy, and even a comfortable life.

KILDARE, an inland county in the province of Leinster, in Ireland, is bounded on the north by the county of Meath, on the east by those of Dublin and Wicklow, on the south by that of Carlow, and on the west by the King's and Queen's counties. In shape it somewhat resembles a truncated cone, having its base resting on Meath, and its vertex cut off by the intervention of Carlow. In its greatest length, measured from north to south, it extends forty miles, and twenty-six in its greatest breadth from east to west, comprehending an area of 392,435 acres, or 6132 square miles, of which 325,117 acres are cultivated ground, and 66,447 are unprofitable mountain or bog.

According to some writers, the Eblani were the inhabitants of this county in the time of Ptolemy; others, amongst whom is Whitaker, make it the habitation of the Coriundi. Afterwards it formed part of the territory of Cealan or Galen, which likewise extended over some parts of Wicklow and Carlow. Its present name is derived from Chille or Kill Dara, the forest or church of oaks, the country being formerly covered with trees. The principal family in this district, previously to the arrival of the English, was that of the O'Kellys, whose residence was at the Moat of Ardscull, near Athy. On the death of Dermod M'Murrough, the last king of Leinster, which occurred shortly after the settlement of the English in it, the county formed part of the palatinate of Leinster, granted by Henry II. to Strongbow. When this extensive inheritance was distributed into five portions, amongst the daughters of William, earl marshal, who derived from Strongbow, by intermarriage, through his only daughter, Kildare fell to the lot of Sybilla, the fourth daughter, who married William de Ferrers, earl of Derby, from whom it descended by marriage to the family of De Vesci, and thence by attainder to that of the Fitzgeralds or Geraldines. The principal families which held under Strongbow and his descendants were those of De Hereford, Fitzhenry, Phepoe, Pippard, d'Angulo or Nangle, and Bermingham. The Fitzgeralds ultimately became possessed of the greater part of it. It was one of the twelve counties into which King John, on his arrival as lord of Ireland, divided that part of the island which acknowledged the English jurisdiction, but was not finally separated from the adjoining county of Dublin, to which it had been attached as a liberty, until the close of the reign of Edward I., when it was empowered to have sheriffs and courts of its own. The county is now divided into the fourteen baronies of Carbery, Clane, Connell, Ikeathy and Oughterany, Kilcullen, Kilkea and Moone, North and South Naas, East and West Narragh and Rheban, East and West Ophaley, and North and South Salt. These baronies are subdivided into seventy-nine entire parishes, and seven parts of parishes, the remaining parts of which are in some of the adjoining counties.

According to the ecclesiastical arrangements, the county contains 113 parishes, fifty-six of which are in the diocese of Kildare, and fifty-seven in that of Dublin, besides a part of a parish which extends into the diocese of Meath. Kildare diocese extends also into the King's and Queen's counties. The bishopric was founded in the sixth century, by St Conleth, who was buried near the great altar of his own church. The chapter consists of a dean, precentor, chancellor, treasurer, four canons, and seven prebendaries. The bishop takes precedence of every other except Meath; all the rest rank according to the dates of their consecrations. Notwithstanding the elevated position he holds, his episcopal income, in consequence of the dilapidations of his predecessors, is extremely small, amounting only to L.520

a year; neither has he any episcopal residence, so that, in order to supply the deficiency of his revenue, he holds the deanry of Christ Church in commendam. The city of Kildare is a small, poor place, wholly unworthy of notice, except from the circumstance of being the seat of the bishopric, and from the cathedral, and some monastic remains still existing. This bishopric is one of those to be extinguished. After the demise of the present incumbent it is to merge into the archbishopric of Dublin.

By much the greater part of the county is a flat, interrupted only by a range of low hills in the centre, the most northern of which is the hill of Allen, and the southern those of Dunmurry; the land on the eastern boundary, toward Dublin and Wicklow counties, gradually rises as it approaches the adjoining mountain tracts. The general surface stands at an elevation of from 200 to 300 feet above the level of high water, giving birth to several rivers. The Boyne, with its tributary the Blackwater, rises in the bog of Allen in the northern part, as does the Lesser Barrow, which unites with the Greater Barrow near Rathangan. The Grees and Lane are small branches of this latter river, joining it near the southern extremity of the county. The Barrow forms the western boundary of the county, except in the neighbourhood of Athy, where the Mearing embraces some land to the west of this river, which should more properly form part of the Queen's county. The Liffey enters the county from the west near Ballymore-Eustace, and after sweeping through it, at first in a western and then in a northern direction by Kilkullen Bridge, Clane, and Celbridge, receiving in its course the Morrel and the Ryewater, it quits the county at Leixlip. Numerous lesser streams, rising in the more elevated tracts, fall into one or other of these rivers. A great part of the bog of Allen lies in the northern part of the county. This bog is not an interrupted morass, but is intersected in many places by elevated tracts of firm ground, the largest of which, lying in its southern part, has obtained the name of the Island of Allen, in consequence of its being surrounded by an unproductive and half fluid mass. To the south of the town of Kildare is a tract of undulating ground, covered with fine sward, of a vivid green, uninterrupted by any plantation. It is called the Curragh. It extends nearly five miles in a south-eastern direction, having an average breadth of a mile, and containing 8000 acres. It is used principally as a sheep walk, for which it is peculiarly adapted, from the quality of its herbage and the dry elastic nature of its soil. The pasturage is held by the farmers of the surrounding lands, who pay large rents for the exclusive privilege of grazing sheep on it, in numbers proportioned to the quantity of land without its limits. The most celebrated race-course in Ireland is on the Curragh. The softness and elasticity of the turf render it peculiarly suitable for this sport. Races are held here periodically, at which two plates of L.100 each are granted by the government, to encourage the breeding of running horses. The climate is moister than most other parts of the great limestone plain of Ireland. The soil of the county is generally a rich, heavy loam, on a bottom of limestone or limestone gravel, except in some insulated spots in the hilly districts. Copper ore is said to have been found in the central hills; but, either from deficiency of quality or quantity, or from a still more marked deficiency of fuel, none is now raised. The hill of Allen consists of a gritstone of which millstones are made.

The population was as follows, according to the authorities stated beneath, at the respective dates.

1760	De Burgo	51,726
1772	Beaufort	56,000
1812	Parliamentary return	85,133
1821	Ditto	99,065
1831	Ditto	108,401

The parliamentary return of 1834 being made according to dioceses, an accurate inference of its population at that period cannot be deduced from it. From these returns it appears that the population doubled itself in seventy years. When compared with the acreable contents of the county, it also exhibits an average of one inhabitant to every three acres, or of one family to every eighteen acres, and of 177 inhabitants to every square mile. The proportion of Protestants to Catholics may be estimated as about one to seven.

This population was represented in the Irish parliament by ten members, two for the county and two for each of the boroughs of Athy, Kildare, Naas, and Harristown. All these boroughs were deprived of the right of returning members by the act of union, and as the reform act has made no alteration in this point, the representation is at present confined to the two county members.

The state of the constituency before and since the alterations made in 1829, and subsequently, respecting the qualifications for exercising the elective franchise, is as follows:

Date.	L.50.	L.20.	L.10.	40s.	Total.
1st Jan. 1829,	376	80	—	496	952
1st Jan. 1830,	385	86	25	—	496
1st May 1832,	221	155	746	—	1122

The constabulary consists of five chief constables, forty-five constables, and 179 sub-constables, total 229, who are maintained at an expense of L.9644, being at an average of somewhat more than L.42 each.

The number of children receiving instruction in public schools, according to returns made under parliamentary authority in 1821 and 1824–26, are as follows:

	Boys.	Girls.	Sex not ascertained.	Total.
1821,	3398	2393	—	6391
1824–6,	5118	3578	161	8857

Of the number in the latter return, 1425 were of the established church, 7276 were Catholics, thirty-one dissenters, and 125 whose religious persuasion was unascertained. The number of schools was 214, of which twenty-five containing 1623 pupils, were maintained by grants of public money; twenty-nine, containing 1707 pupils, by voluntary contributions; the remaining 160 schools, containing 5527 pupils, were wholly supported by the fees paid by the parents or guardians of those receiving instruction. The diocesan school for the see of Kildare is held in Naas. The head master receives a salary of L.60 per annum from the bishop, in addition to the pupils' fees.

The lands are very unequally portioned out. There are a few large estates. That of the Duke of Leinster extends over nearly one third of the county. Many of the farmers hold large tracts; many others quantities scarcely sufficient for the sustenance of a family. The general average of farms is from 200 to ten acres. The former are well cultivated according to the most approved systems, though not with all the neatness and precision which mark the operations of the English agriculturist. The small farmers manage their land in a slovenly manner, and with a persevering attachment to the customs of their forefathers. Oxen are worked along with horses in the plough. Mules are to be often seen about the farm-yards. Tillage in partnership is very usual. Wheat is grown in large quantities, the strong loam being well adapted for it. The lands not subjected to the plough are very rich, fattening grounds; but when exhausted by injudicious courses of cropping, the pasture is poor and light. Dairies of any extent are seldom to be met with, except for the purpose of raising veal for the Dublin market. Large flocks of sheep are uncommon. The breeds both of black cattle and sheep are good; that of horses is injured by an excessive passion for breeding racers. The dwellings of the middling farmers generally consist of a long building of a single story, the lower part formed of stone and mortar, the upper of clay thatched with straw, and divided in the inside into a kitchen and two sleeping rooms, one at each end. In the front is a yard or bawn, enclosed at each side by the stables, barn, and cow-houses, and used as a repository for all the manure collected from the dwelling-house and offices, and for the feeding of the cattle. In the anxiety to collect manure, little attention is paid to neatness; the pile of it is generally heaped up in front, and a trough or cess for collecting the liquid is formed near the family door, to which the pigs have usually free access. The habitations of the labourers or cottiers are very wretched, particularly those living in or near the edges of the bogs. The cabin is sunk beneath the surface of the soil, in order to diminish the quantity of wall to be built. The roof, thatched with sods of turf pared off the surface of the bog, is but a few feet above the ground, and assimilates so closely with the appearance of the surrounding fields as to be nearly imperceptible at a short distance, except from the smoke rising out of its openings, or the ingress and egress of children and domestic animals through the hole in the side intended for a door. The food of the peasantry is potatoes, with some milk and butter occasionally. The use of flesh meat is little known, except on a few high holidays. The fuel is universally turf, which may be said to be the only thing the poor man here has in plenty. The clothes are made of home-manufactured frize, or cheap cottons. The English language is in general use.

Manufactures can scarcely be said to exist here. That of cotton was attempted at Prosperous, near Clane, but failed. An extensive woollen factory has been for several years at work near Celbridge, and still continues to produce large quantities of the coarser woollen cloths. Paper is also manufactured in some places, and tanning is carried on to a considerable extent. The county affords many fine sites for water-mills. The beautiful falls of the Liffey, at the salmon-leap near Leixlip, offer a perennial command of water adequate to move very extensive machinery. Many other falls are to be met with on the same river in its course through the county. The locks of the canals also could supply water for many lesser works. The Grand Canal enters the county from the Dublin side, at Hazelhatch, eight miles from the harbour at Portobello, and passes through it in a south-western direction to Sallins, where there is a short branch to the town of Naas. The main trunk proceeds in a western direction to Lowtown, at which place it divides into two branches, the one, proceeding westward to the Shannon, near Banagher, quits the county at Edenderry; the other, which takes a more southern direction, joins the Barrow at Monasterevan, the western bank of which river it follows as far as Athy, where it ceases, the river navigation from that point to the sea being deemed sufficient for the purposes of inland navigation. The summit-level, commencing at the distance of seven miles from Dublin, and extending four miles, is 264 feet above the level of the sea at high water. The Royal Canal, which skirts the northern boundary of Kildare, enters the county at Leixlip, and proceeding by Maynooth, Kilcock, and Cloncurry, quits it for the county of Meath at the Boyne. Both these carry to Dublin large quantities of turf, which is much used for fuel by the lower classes in the metropolis; also bricks, stone, flags, slate, grain of every description, and potatoes; and bring back chiefly manufactured goods, timber, and foreign groceries. The vicinity of the two canals during their transit through the county diminishes considerably the general extension of the benefits that ought to accrue both to the metropolis and to the line of country which they traverse: in one part of their course they approach within four miles of each other.

The remains of antiquity are numerous. There are five round or pillar towers. That at Kildare is said to be the most perfect in Ireland; it is 130 feet high. At Taghadoe there is another seventy-one feet high. The third, at Kilcullen, has only forty feet standing. The fourth, at Oughterard, has suffered still more severely from the ravages of time; its height is but twenty-five feet. The fifth, which stands at Castledermot, is used as a belfry, and by a casual spectator might be mistaken for the trunk of a lofty tree, in consequence of its being enveloped with a covering of ivy from its base to its summit. Several of the upright stones, supposed to be relics of the worship of Baal, are also to be seen. One at Punch's Town stands twenty feet above the ground; another, with a conical top, is at Harristown; two others, situated at Jigginstown, are known by the name of the long stones; another, called the Gobhlan, is near the hill of Carmen or Mullamast, where is also to be seen a large rath, situated on the summit of a hill of some elevation, near which are sixteen smaller raths or hillocks. These are said to have been the seats of the elders when the assembly of the states of Southern Leinster, under the name of Naasteighan, was held on this eminence. At a later period it became more memorable from a tragedy acted upon it by some of the English settlers, who, having invited the neighbouring Irish chieftains to a conference there, for the amicable settlement of their disputes as to territorial boundaries, fell upon them unexpectedly, and slaughtered them to a man. The pit into which the heads of the victims of this murderous act of treachery were flung is still shown; and the place thence acquired its name of Mullamast, or the Hill of Decapitation. The other raths of most note are those of Ardscull, near Naas, where the English, under Hamo de Gras, were totally defeated by Edward Bruce in 1315; and that of Rheban, to the north of the same town. Others are still to be seen at Naas, Kilkea, Moone, Clane, and Lyons, and at Rathsallagh. The abbey of Kildare is one of the oldest in Ireland. It is said to have been founded by St Brigid, and was the place where the sacred fire was kept, which, after being extinguished by Henry de Loundres, archbishop of Dublin, in 1220, was again lighted and kept burning till the reformation. The ruins of the building in which it was kept are still shown. There were, besides this, an abbey of gray friars, and another of Carmelites or white friars, in the town. Castledermot had also three great monasteries. A parliament was held in one of them in the year 1499. Naas had an Augustinian and a Dominican abbey. The fine abbey of Monasterevan was converted into a mansion-house for the Moore family. Of that of St Woolstan's, near Celbridge, nothing now remains but two towers and gateways. The commandery of Tully, formerly belonging to the knights-templars, is now held in commendam with the bishopric of Kildare. At old Kilkullen, the site of the monastery is marked by some curious stone crosses. The principal castles are those of Kilkea, said to be built by De Lacy in 1180; those of Athy and Castledermot were built by the eighth Earl of Kildare. Timolin Castle was erected in the reign of King John, by the Lord of Norragh. Rheban, on the Barrow, gave the title of baron to the family of St Michael. The castles of Narraghmore and Harristown also gave baronial titles to their possessors. Amongst the modern seats, the most remarkable are Carton, belonging to the Duke of Leinster, a princely residence, near the town of Maynooth; Castletown, the seat of the Conolly family, and Killadoon, that of Lord Leitrim, in the same neighbourhood; Lyons, on the banks of the canal, the splendid mansion and demesne of Lord Cloncurry; Straffan, on the Liffey, between Celbridge and Clane, belonging to the Henry family; Belan, near Timolin, that of the Earl of Aldborough; and Palmerston, the Earl of Mayo's. At Jigginstown, near Naas, are still to be seen the walls of a large mansion commenced by the unfortunate Lord Strafford, whilst lord-lieutenant under Charles II., but never finished.

There is no large town in the county. The population of neither of the assize-towns amounts to 5000 souls. That of Athy, the larger, was, in 1831, 4494; and of Naas, 3808 souls. The former of these towns is situated on the banks of the Barrow, which is here crossed by a bridge, and owes much of its small population to its being the point of connection between the still-water navigation of the Grand Canal, which terminates here, and the river navigation of the Barrow. It was incorporated by James I. under the care of a sovereign, two bailiffs, and twelve burgesses. The assizes are held here once a year; and its old castle has been converted into a prison for the temporary detention of culprits. A free school, capable of receiving 270 children, is the only modern public building of any importance. Naas, situated on the Liffey, and communicating with the main trunk of the Grand Canal by a connecting branch, though less populous than Athy, has a better right to the name of the county town, as being the site of the principal prison; besides which, it can boast of a large Catholic chapel, a sessions-house, and a market-house. In other respects it presents nothing worthy of notice. Maynooth is remarkable for several castellated ruins, built at various times by members of the Fitzgerald family; and for being the site of the Roman Catholic College, founded for the education of the priesthood, and supported by an annual parliamentary grant. Its population is only 2052 souls. The other towns whose population exceeds one thousand souls are, Kildare, 1753; Kilcock, 1730; Celbridge, 1645; Monastcrevan, 1441; Castledermot, 1375; Clane, 1216; Rathangan, 1165; Leixlip, 1156; Prosperous, 1038.

KILDERKIN, a liquid measure, containing two firkins.

KILGERRAN, a town of Pembrokeshire, in South Wales, 231 miles from London, on the river Tivi. It is a corporate town, and had once a market, which has been discontinued. The inhabitants amounted in 1801 to 854, in 1811 to 769, in 1821 to 862, and in 1831 to 879.

KILKARY, a town of Hindustan, on the sea-coast of the Carnatic, and district of Minawas, 127 miles north-east from Cape Comorin. Long. 78. 53. E. Lat. 9. 15. N.

KILKENNY, an inland county, in the province of Leinster, in Ireland, is bounded on the north by the Queen's county, on the east by the counties of Carlow and Wexford, on the south by the county of Waterford, and on the west by that of Tipperary. It comprehends an area of 513,686 acres, of which 417,117 acres are cultivated land, and 96,569 acres are bog and mountain.

The parish of Durrow, forming an insulated portion surrounded by the Queen's county, was made part of the county of Kilkenny by an act of parliament, obtained through the influence of the Duke of Ormond. His object was to repress the outrages committed on his tenantry by the Fitzpatricks, who inhabited that district, and who, when tried in the Queen's county, which belonged to their own sept, were always acquitted, but when tried in Kilkenny, the duke's county, were sure to be convicted.

According to Ptolemy, the county was inhabited by the Brigantes and the Caucoi. It afterwards formed part of the kingdom of Ossory, which was sometimes tributary to Leinster, sometimes to Munster. After the arrival of the English, it formed one of the counties into which King John divided that portion of the island which recognised his supremacy. At the termination of the sixteenth century it was chiefly occupied by the Graces, the O'Brenans, the Butlers, the O'Sheas, the Rooths, the Harpurs, the Walshes of the mountains, the Shortals, and the Forstals. It is now divided into the nine baronies of Crannagh, Fassadining, Galmoy, Gowran, Ida, Iverk, Kells, Knocktopher, and Shillelogher; besides which, the county of the city of Kilkenny forms a separate jurisdiction. These baronies are subdivided into 126 parishes, and one part of a parish.

According to the ecclesiastical arrangements of the country, Kilkenny is chiefly comprehended within the diocese of Ossory, which extends over 120 of its parishes. Of the remainder, six are in the diocese of Leighlin, and part of one in that of Cashel. The see of Ossory was first planted at Seikyran, near Birr, about the year 402. Thence it was removed to Aghaboe, in the Queen's county, about 1052; and finally to Kilkenny, in the latter end of the reign of Henry II. Like Meath, it derives its name, not from the seat of the episcopal see, but from that of the district over which it extends. Besides nearly the whole part of the county of Kilkenny, the diocese also comprehends the entire barony of Upper Ossory, forming one third of the Queen's county, and a small part of the King's county. The dean of the cathedral exercises a kind of episcopal jurisdiction over the vicars-choral, similar to that of the dean of St Patrick's, Dublin; and the archdeacon formerly exercised an ordinary prescriptive jurisdiction over the whole diocese. The total number of its parishes is 136, of which 120 are in Kilkenny, fifteen in the Queen's, and one in the King's county. The annual value of the see was estimated at L.3859 by the parliamentary return made in 1833. In conformity with the new arrangements for the established church in Ireland, this diocese has been consolidated into that of Leighlin and Ferns.

The face of the country is mostly level, particularly in the central baronies; but hilly in the northern, and still more so in the south-eastern districts. An argillaceous soil is predominant. Very little ground is unfit for tillage, and that which is not productive of good grain throws up excellent herbage. The soil in the northern parts is chiefly a mossy turf a few inches deep, lying over a bed of stiff yellow or whitish clay. More southerly, the soil is light, covering an argillaceous schistus. To the west there is a hungry clayey loam, over a bed of limestone. In general, the nearer the limestone is to the surface, the poorer the soil. A light soil covers all the vicinity of the city of Kilkenny, exhibiting the appearance of slaty hills and gravelly bottoms. Proceeding southwards, the fertility increases. The angle of the river Suir, which forms the parish of Portnascully, is the richest land in the county. There is a great extent of mountainous land, much of it unimproved. The quantity of bog is inconsiderable, amounting altogether to 3500 acres; the largest tract is in the north-western extremity. Marl has been found between two strata of black turf mould; three strata of bog have also been discovered, separated by intervening beds of marl, oak, fir; sallow and birch have been found in the bogs. There are no loughs of any extent. In the parish of Cloghmanta there are some temporary lakes, produced by the water bursting up from the ground in November, and subsiding in spring. They are here named Loughans; in Connaught they are called Turloughs. The climate is less humid than that of Dublin or Wicklow.

The principal rivers are the Nore, the Barrow, and the Suir, all of which rise in the range of the Slieve Bloom Mountains, and, taking a southern direction, discharge themselves by a common mouth into the estuary at Waterford. The Nore passes through the middle of the county, and by the city of Kilkenny; it is navigable for boats as far as Thomastown, whence a canal has been for many years proposed to be carried to the last-named city; but it still remains uncut. The salmon-peal, a fish resembling the salmon, is caught in this river. The King's River joins the Nore at Jerpoint, and the Argula near Innistioge. The Barrow forms the eastern boundary of the county, from near New Bridge to its junction with the Suir, which latter river is its boundary to the south. The Barrow is navigable for boats along the whole extent of the borders of the county of Kilkenny, and still farther to Athy in Kildare county. The Suir is navigable for sloops to Carrick, and for barges to Clonmell in Tipperary.

The substrata of this county are granite, siliceous schistus, siliceous breccia, argillite, sandstone, and limestone. The granite hills form a very small part, being merely the extension of the Wicklow group. The rock is of various shades, but the best is of a light yellow tint, finely grained, and compact; black mica is found in it, together with specks of iron ore, and crystals of schorl. Siliceous breccia forms many of the lower hills. It consists principally of fine quartz sand, united by a siliceous cement, and enveloping rounded pebbles of quartz. This stone is constantly accompanied by a red argillite, which covers the sides of the hills, but scarcely ever the summits. The hills of breccia run southward from the Nore towards Waterford. The great hill of Drumdowney, near the Ross River, forms the extremity of the principal range. The stone is here of a fine grain, and is quarried for millstones, which are exported to Cork, Dublin, and other parts. In the western part of the county there is an extensive slate quarry, highly esteemed. The northern part of the county consists either of ferruginous argillite or of siliceous schistus. The former, from being always found above coal, is called coal-cover.

The collieries of Castlecomer are situated near the confluence of the small rivers Dinan, Dian, Bruckagh, and Cloghoge, which join the Nore. They were discovered by accident, in working for iron ore. The depth of the beds varies from two feet six inches to three feet one inch. The coal sill, or seat of the coal, which is sometimes raised with it, is a soft, black, brittle stone, full of shining impressions, exhibiting obscure traces of the roots of rushes. It stands fire in a peculiar manner; crucibles made of it resist the strongest heat, as, the more it is exposed to the fire, the harder it becomes. Fire-bricks are made from two parts of it and one part of clay. The excellent qualities of the Kilkenny coal for particular purposes occasion a great demand for it. It is heavy, burning with little flame, like charcoal in an ignited state, and throwing out a steady and violent heat. It dries malt well, and is excellent for the forge. When analyzed, it appears to approach nearly to pure carbon, the proportions being 97·3 of that element, and the remainder uninflammable ashes. It seems peculiarly calculated for cementing steel, and for potteries; but it has not been applied to either purpose, although materials for earthenware are to be found in the neighbourhood, and iron-mines of the best quality from the upper strata of entire hills. Yellow ochre is found in various places; also pipeclay of good quality. Manganese is seen on the banks of the Barrow, and near Freshford, and lead in small quantities between Innistioge and Ross; a mine of the latter at Floodhall was worked for some time with considerable profit. Iron has also been raised. Jasper, in pieces from ten to twelve inches long, and half as broad, have been found near the extremity of the granite district, between the Nore and Barrow. Limestone is the base of the central part of the county; but the quality varies much in different places, all the species of it containing impressions of shells or corallines. The most important limestone quarry is that which produces the Kilkenny marble; it lies about half a mile from the city. The stone, when polished, presents a black ground, varied with white marks, which appear more strongly when exposed to the air; but that approaching nearest to unmixed black is most esteemed. The analysis gave ninety-eight per cent. soluble in marine acid, and two per cent. of a black powder, which appeared to be carbon. The blocks, when raised, are finished at a marble-mill at some distance, remarkable for the ingenuity and simplicity of its mechanism.

At Ballyspellan, in Galmoy barony, is a very celebrated mineral spring. It is a chalybeate, and contains carbonic acid gas, which soon evaporates on exposure to the air. Its medicinal qualities have long been highly esteemed in the neighbouring country. Chalybeate springs, but not of much strength, exist in other places. This county is also celebrated for springs of very pure transparent water, most of them dedicated to some saint, whose patron-day is annually celebrated on their verge.

The population, taken at different periods, presents the following results:

1760	De Burgo	62,832
1792	Beaufort	100,000
1812	Parlimentary census	134,664
1821	Ditto	158,716
1831	Ditto	160,283

This table exhibits an increase of more than double in seventy years, and gives an average of one inhabitant to every three acres and a quarter, or of a family of six to every nineteen acres.

The parliamentary returns of the numbers of children receiving education in the public schools, in the years 1821, and 1824–26, give the following results:

	Boys.	Girls.	Sex not ascertained.	Total.
1821,	10,191	4,420	—	14,511
1824–26,	12,398	7,000	274	19,672

Out of this total of children enjoying the benefits of public instruction, according to the latter of these returns, upwards of 18,000 were Catholics; the Protestants amounting only to 1376, of which number but thirteen were dissenters. The number of schools maintained by public money was nineteen, in which 1515 pupils were instructed; of those maintained by private subscriptions, the number was the same, the pupils in them being 1281; all the other schools, 346 in number, in which 16,876 children were instructed, were maintained wholly by the fees of the pupils. From the same data, it may be inferred that the Catholics in the county of Kilkenny were to the Protestants at that time in the proportion nearly of twenty to one.

The county returned sixteen members to the Irish parliament, two for the county at large, two for the city of Kilkenny, two for the adjoining borough of Irishtown, and two each for the boroughs of Callan, Gowran, Innistioge, Knocktopher, and Thomastown. All these, except Kilkenny, were close boroughs, the elective franchise being vested in the burgesses, whose number seldom exceeded twenty, and who were elected through the influence of the proprietor of the land. The constituency of the county was as follows, before the Catholic relief act, after that act but previously to the reform act, and subsequently to the reform act:—

	L.50.	L.20.	L.10.	40s.	Total.
1829,	689	210	—	2353	3261
1830,	726	234	118	—	1024
1832,	222	106	918	—	1246

Very little ground throughout the county is unfit for tillage; the central parts are peculiarly adapted for wheat, to the growth of which the best ground, most of which has a limestone sub-soil, is devoted. The more mountainous tracts are exclusively appropriated to oats or pasture. Wheat is sown either on a fallow or after potatoes. The seed is always steeped for a day and night, in which process brine has been found most effectual in guarding against smut. Wheat here suffers also from what is called the red or yellow worm; but as this disease appears only in dry seasons, when the crop is better and more abundant, the evil is not much felt. Change of seed is much attended to. Barley is usually sown after wheat. Bear is little cultivated. The same may be said of rye; when raised, it is sown on burned land, and produces fine crops in the mountainous districts. All the manure that can be collected is applied to the potatoes. The street scrapings of Waterford bear a high price in the neighbouring baronies; sea-sand and composts of turf mould are also common. The use of green food for cattle is not so general as might be desired. Many of the cattle graze out during the winter; some are housed from Christmas to April. The only green food used in winter is furze-tops pounded, on which the cattle soon become sleek and fine skinned; for this purpose the large French furze is preferred. Little attention is paid to improve the pasturages. The mountain pastures are left in a state of nature, and the land produces little but heath. These heaths are very liable to take fire in dry summers, by which means the soil is eventually improved. Much land on the borders of the Nore and Suir is embanked and used for meadowing. The most considerable dairies are in the Walsh Mountains; a name supposed to be derived from the family to which a large tract of land formerly belonged. It is now mostly held by a single family, consisting of five branches, who possess upwards of two thousand acres amongst them. Their houses are small and contiguous. They intermarry amongst each other, which renders ecclesiastical dispensations frequently necessary. If a widow marry a stranger, she loses all except what she had brought with her to her first husband. The land is grazed in common, excepting three hundred acres, which are divided equally among the five families. They live principally on potatoes and griddle bread, with occasionally the offal of the pigs killed for sale. Their dairies have earthen floors, and are without ceiling, window, table, or shelf, but they are kept very neat.

Few horses are bred in the county, most are brought in from Munster to the fair of Callan, the only esteemed fair for this description of stock. The Suffolk sorrel breed is much in request. The common stock of black cattle is a cross of the Irish breed on the long-horned English. The Kerry cow is much in demand in dairies, for its low price and quantity of milk. The breed of sheep has improved very much, in consequence of the great pains taken to improve it. Merinos have been successfully introduced. Pigs are fattened to the weight of five hundred lbs. Goats are kept by small farmers and cottiers, but not in flocks. Rearing fowl is also an object with the small farmers. Large numbers of turkeys are sent to the autumn fair of Callan. Bees were more attended to formerly than now, yet the soil and climate are well suited to them. The dry hills, covered with heath and scented herbs, produce honey celebrated for its flavour, and for the depth of its combs.

Within the memory of some old persons, many parts of the county were covered with woods. Now there are but few, not covering more than two thousand acres. Attempts to raise plantations from the seed have not been successful, the seeds in this mild climate being liable to destruction from vermin. Orchards are much neglected. There are some ozieries on the banks of the Nore and Suir.

The woollen manufacture was introduced by the Earl of Ormond in the early part of the fourteenth century. He brought over workmen from Flanders, whose manufacture is still to be seen in the castle of Kilkenny. James duke of Ormond went to great expense to introduce the linen manufacture in the seventeenth century. Latterly an attempt was made to manufacture superfine broad cloths in the neighbourhood of Kilkenny, but it soon failed. Frizes and ratteens are still made; the women spin the wool. The manufacture of woollen cloth was succeeded by that of blankets, which is still carried on. The linen trade, after a continuance of fifty or sixty years, has so died away that not a vestige of it now remains, beyond the making of coarse linen and sacking for domestic use. There are salt-houses at Kilkenny, Newbridge, and Kilmurry. Paper is manufactured in several places. Bolting mills are numerous on the great rivers. The principal part of the grain raised in the county is sent to Dublin in the form of flour, malt, and meal, the manufacturing of which is another source of wealth.

The number of resident gentry is considerable. Amongst the mansions remarkable for splendour or for architectural beauty are, the castle of Kilkenny; Mount Juliet, the seat of the Earl of Carrick; Desart, the seat of the Earl of Desart; Kilfane, that of George Power, Esq.; Flood Hall, the residence of the head of the Flood family; and Besborough, the seat of the Earl of Besborough. Gentlemen's seats are numerous and elegant. The farm-houses are of stone, more generally cemented with clay than with mortar; the offices usually forming an irregular yard in front of the house. The people in the hilly parts, who hold land at will, live in scattered villages. The usual food of the peasantry is potatoes, to which milk and salt are sometimes added, and occasionally a herring. Turf is the general fuel, except in the neighbourhood of the collieries, where coal is burned, or else culm made up in balls with one third of clay. The clothing is frize, ratteen, and flannel. The women wear stuff petticoats and straw-hats manufactured at home. Spirituous liquors are seldom used, excepting at fairs, patrons, wakes, weddings, and christenings. One person at least from every family in the village is expected to attend at a wake, and the body is often conveyed many miles to the family burial-place. Irish is the language generally spoken, particularly in the hilly districts and in the western parts, where the priests frequently preach alternately in Irish and English.

Amongst the remains of antiquity may be noticed a circle covered with stones on the summit of Slieve Grian, "the Hill of the Sun," called also Tory Hill, on one of which is an inscription that has given rise to much controversy. There is another circular mound of stones on the hill of Cloghmanta, which signifies "the Rock of God." The most remarkable cromleach is at Kilmogue; its upper stone is forty-five feet in circumference. The country people call it Lachan Schal, or "the Great Altar Stone." Near the spa of Ballyspellin is a large stone, formerly supported by others; it is called Clogh-bannagh, or "the Stone of Blessing." Raths are numerous, particularly in Galmoy and near the Nore. At Earlsrath are the remains of a very large fort enclosed by a fosse. A moat near Rathbeath is pointed out as the place where Heremon, son of Milesius, built his palace and was buried. There are five pillar towers in the county. One is in Kilkenny, close to the cathedral; the others are at Tulloherin, Kilree, Fertagh, and Aghaviller, of which last the lower part only remains. All are in the vicinity of places of worship. Besides the remains of monasteries in the city of Kilkenny, there are vestiges of some others, once of great note, particularly one at Jerpoint, and another at Graige, both of the Cistercian order. The Dominicans had abbeys at Rosbercon and Thomastown, the Carmelites had one at Knocktopher; and there was a nunnery at Kilculliheen.

The number of castles is very great; most of them consist of a single square tower, which formed the keep. Graney or Grandison Castle, in Iverk, is among the most celebrated, as being the residence of Margaret Fitzgerald, the great Countess of Ormond, a woman of uncommon energies. King John built a castle at Tybrachny, where there are the remains of a Danish town.

KILKENNY city is situated on the river Nore, nearly in the centre of the county. Its name is generally derived from Kill-kenny, "the church or cell of St Canice," though by some it is traced from the words Coil-ken-ui, "the wooded hill near the river." It consists of two separate jurisdictions, the city of Kilkenny properly so called, and the borough of Irishtown, separated from each other by the small river Bregagh. An English settlement was formed here shortly after the landing of Strongbow; a castle was also erected, and the seat of the see of Ossory removed thither. William lord marshal, who married Strongbow's daughter, granted the town a charter of incorporation, which was confirmed by Gilbert earl of Clare. Elizabeth and James I. confirmed and enlarged its privileges. Parliaments were frequently held in it; amongst others, that which passed the celebrated statute of Kilkenny, which first notices the distinction of English by blood and English by birth. During the wars of 1641, it was the place where the assembly of the confederate Catholics held their sittings; the room where they met is still shown. Cromwell afterwards took the city on terms highly honourable to its defenders, and afterwards held his high court of justice in it. The buildings in the city and borough together occupy an area of about 380 acres. On the two most elevated points of the united towns are the castle and the cathedral, the most marked and ornamental structures of both. The city is irregular, but presents a cheerful and busy aspect: the houses, built chiefly of stone, are large and respectable. The Nore, here a river of some breadth, though not navigable, is crossed by two modern bridges. The castle comprehends the remains of the ancient fortress, combined with more modern buildings. It was purchased by James, third earl of Ormond, in 1391, and has ever since been the principal residence of the head of the Butler family. In 1399, he entertained Richard II. in it for fourteen days. King William dined there after the battle of the Boyne. The buildings now form the sides of a quadrangle. Its principal apartments were the presence chamber, formed of a suite of rooms opening into one another, in the farthest of which was an elevated seat for the lord of the mansion; and the picture gallery, chiefly furnished with family portraits. Several of the rooms were hung with tapestry; but the whole is now undergoing such alterations as will materially change the state of the interior without altering the feudal character of its exterior. The court-house is a large and elegant modern building, erected on the site of Grace's old castle, where the assizes used to be held. The tholsel, or city court, is also large, but unornamented; it contains several apartments, one of which is used as a library. The market, well stocked with provisions of every kind, is held in one of the divisions of its inferior area. There are barracks both for cavalry and infantry. The theatre is small, and was for some time kept open by an amateur company, composed of the neighbouring resident gentry. The county jail is at a short distance from the city. The environs of the town are very beautiful. The Duke's Walk is carried from it upwards of a mile along the banks of the Nore. The corporation consists of a mayor and aldermen, two sheriffs, a recorder, and other subordinate officers, who have the management of an income, arising from rents, of about L.1600 per annum. The cathedral of St Canice is an extensive pile, on a commanding elevation, in Irishtown. It is cruciform, surmounted by a small tower, and of greater dimensions than any similar building in Ireland, except the cathedral in Dublin. In the north transept is a chapel used as the parish church, where also is a stone seat called the chair of St Kevin. The choir and chancel are fitted up in a style of chaste simplicity. The aisle contains several sepulchral monuments; amongst them that of Pierce, eighth earl of Ormond, and Margaret Fitzgerald his wife. The burial-ground of the cathedral is entered by a flight of marble steps, and is planted with trees. The episcopal palace was originally erected in the time of Edward III., and was modernized and enlarged in 1735; it is now a commodious, though not a splendid residence. The church of St Mary is a spacious but plain structure. Several monastic institutions added much to the beauty and dignity of the city. The most ancient was the preceptory of St John, founded about 1211. The abbey church, remarkable for the singular structure of its windows, which procured it the name of "the Lanthorn of Kilkenny," has been converted into a parochial church under its old name. The extensive and noble ruins of the Dominican or Black Abbey, founded in 1225, have been repaired, and now form a Roman Catholic place of worship. The origin of the Franciscan Abbey is unknown. Its ruins are much admired. The grammar-school, generally called the college, is situated near the banks of the Nore. It was founded by Pierce earl of Ormond, and re-endowed by the Duke of Ormond in 1684. James II. erected it into a royal college, but on his abdication it reverted to its former state, and is now a respectable place of elementary instruction, capable of accommodating eighty resident pupils. In it Dean Swift, Congreve, Farquhar, and Bishop Berkeley, acquired the rudiments of classical literature. Kilkenny has also a seminary for the education of students intended for the Roman Catholic priesthood. A nunnery provides for the education of twelve boys and as many girls. The charter-school is adapted for seventy children. The infirmary, opened in 1767, is supported partly by grants of public money, partly by benefactions and subscriptions. The house of industry provides for the maintenance of the poor when out of employment; and an hospital for lunatics is attached to it. A neat range of buildings, called St James' Asylum, in the suburbs, was endowed in 1803, by Mr James Switzer, for the maintenance of twelve protestant and eight catholic widows. The population of the city and borough in 1821 amounted to 23,230 souls, and in 1831 to 23,741. The other towns the population of which exceeds one thousand souls each are, Callan, 6111; Thomastown, 2871; Castlecomer, 2436; Freshford, 2175; Graige, 2130; Ballyragget, 1629; Urlingford, 1336; Durrow, 1298; and Gowran, 1109.

KILLALA, a town of Ireland, in the county of Mayo, situated on a fine bay of the Atlantic, to which it gives name. There are here some small manufactures, but it is chiefly noted as being the place where the French landed in 1798, and of which they kept possession for about a month. It is 192 miles north-west from Dublin. Long. 9. 8. W. Lat. 54. 13. N.

KILLALOE, a town of Ireland, in the county of Clare, situated on the western bank of the Shannon, over which there is a bridge of nineteen arches. It is an old town, and possesses little or no trade; but there is a water communication with Dublin by means of a canal. Killaloe lies eleven miles north-north-east of Limerick.

KILLARNEY, a small town of Ireland, in the county of Kerry. It is a neat, thriving, and well-built place, much frequented on account of the lakes in its vicinity, for a description of which see the article KERRY.

KILLICRANKIE, a noted pass of Perthshire, Scotland, within about two miles of Blair-Athole. It is formed by lofty mountains impending over the river Garry, which rushes through in a deep channel beneath. In the last century this pass was one of some danger and difficulty, and a path hanging over a tremendous precipice threatened destruction at the least false step of the traveller. At present it is traversed by a beautiful road, forming part of the Highland line between Dunkeld and Inverness, and all danger or even difficulty has completely vanished. The finest portion of the pass is at the southern extremity, and

Killicrankie. nearly opposite to the house of Faskally, which is situated on a level paddock at the foot of the precipice, on the right bank of the Garry, which sweeps round the beautiful green spot on which it stands.

Near the northern extremity of this pass, in its open and unimproved state, was fought, in the year 1689, the battle of Killicrankie, between the adherents of James II. under Viscount Dundee, and those of William III. under General Mackay. Dundee's army was inferior in numbers to that of Mackay. When he came in sight of the latter, he found them formed in eight battalions ready for action. They consisted of 4500 foot, and two troops of horse. The Highlanders under Dundee amounted to little more than half that number. At five of the clock in the afternoon, a kind of slight skirmish took place between the right wing of the Highlanders and the left of the enemy. But neither army wishing to change their ground, the firing was discontinued for three hours. Dundee in the mean time passed from clan to clan, and animated them to action. About eight o'clock he gave the signal for battle. The Highlanders in deep columns rushed suddenly down the hill, reserving their fire until they were within a pike's length of the enemy; when, having discharged their muskets, they fell upon the red-coats sword in hand. Mackay's left wing, unable to sustain the shock, were driven by the Macleans with great slaughter from the field. But the Macdonalds, on the left of the Highlanders, were not equally successful. Colonel Hastings's regiment of foot stood their ground, and even forced the Macdonalds to recoil. Maclean, however, with a few of his tribe, and Sir Evan Cameron at the head of his clan, fell suddenly on the flank of this gallant regiment, and forced them to give way. The slaughter ended not with the battle. Two thousand men fell in the field and in the flight. The tents, baggage, artillery, and provisions of the enemy, and even King William's Dutch standard, borne by Mackay's regiment, fell into the hands of the conquerors. The victory was now complete. But the Highlanders lost their gallant leader, who, as he was raising his arm, and ordering the Camerons to advance, received a ball in his side. The wound proved mortal; and with Dundee perished all the hopes of King James.

The battle of Killicrankie, or of Renrorie as the Highlanders call it, was fought to the westward of the great pass, on a level space, in the form of a small amphitheatre, immediately below the house of Urrard, and bounded on the one side by the heights, on a terrace of which that house stands, and on the other by the river Garry, which at this place runs close by the modern road. In the middle of this little plain stands a rude block of stone, which is said to mark the spot where Viscount Dundee received the wound which put a period to his earthly career; but this is most probably a mistake; for, in the first place, if he had descended to the level ground, he could not have commanded a full view of the attack, whereas, by remaining at or near Urrard House, he must have perceived at a glance every movement that took place in the plain below; and, secondly, the tradition is uniform and uncontradicted, that he was mortally wounded by a ball which entered between the joinings of his armour, whilst his horse was stooping to drink at a well on the heights, and at the moment when he was ordering the Camerons to advance. Before the onset, the Highland army was drawn up on the face of the hill, a little above the house of Urrard; a position which gave them the entire command of the pass, and enabled them to attack to the greatest advantage. As Mackay was observing his adversaries, on the hill above, he turned round to young Locheil who stood next him, and pointing to the Camerons, "There," said he, "is your father and his wild savages; how would you like to be with him?" "It signifies little," replied the other, "what *I* would like; but I recommend it to you to be prepared, or perhaps my father and his wild savages may be nearer to you before night than *you* would like." And it happened as young Cameron had foreseen. Dundee delayed his attack until near sunset, "when," according to an eye-witness, "the Highlanders advanced on us like madmen, without shoes or stockings, covering themselves from our fire with their targets. At last they cast away their muskets, drew their broadswords, and advancing furiously upon us, broke us, and obliged us to retreat; some fled to the water, some another way."[1] In short, the charge was like a torrent, and the rout immediate and complete. Some regiments, indeed, withstood the first onset, and regaining their formation, made some show of resistance; but seeing themselves at length turned and abandoned, they soon joined in the flight. It has generally been believed that Dundee fell towards the close of the action; but a letter, which has been preserved, from James VII. to Stewart of Ballechin, who commanded the Athole men, proves the reverse. "If their courage and yours, and the rest of the commanders under you, were not steady," says James, "the loss you had in a general you loved and confided in, *at your entrance into action*, with so great inequality of numbers, were enough to baffle you." The consternation occasioned by the death of Dundee, however, prevented an immediate pursuit through the great pass. Had the discomfited troops been closely followed, and had a few Highlanders been placed at the southern entrance, not a man of them would have escaped. His uninterrupted retreat caused General Mackay to conclude that some misfortune had befallen Dundee. "Certainly," said he, "Dundee has been killed, or I should not thus be permitted to retreat unmolested." (Stewart's *Sketches of the Highlanders*, vol. i. pp. 66, 67.)

Killigrew. KILLIGREW, William, was the eldest son of Sir Robert Killigrew, and born at Hanworth, Middlesex, in the year 1605. At the age of seventeen, he became a gentleman commoner of St John's College, where he remained about three years; he then travelled into foreign parts, and, after his return, was made governor of Pendennis Castle and of Falmouth Haven in Cornwall. At a subsequent period, he attended Charles I. as gentleman-usher of the privy chamber; and, upon the breaking out of the civil war, he commanded one of the two troops of horse which were appointed to guard the royal person. He was in attendance upon the king when the court resided at Oxford; in 1642, he was created doctor of the civil law by the university of that place; and when the king's affairs were completely ruined, he suffered like the other cavaliers, and was obliged to compound with the republicans for his estate. But the Restoration made him some compensation for the losses he had sustained in the royal cause. He was appointed gentleman-usher of the privy chamber to Charles II.; and, upon the king's marriage,

[1] The author of the Memoirs of Dundee, speaking of this battle, says, "Then the Highlanders fired, threw down their fusils, rushed in with sword, target, and pistol upon the enemy, who did not maintain their ground two minutes after the Highlanders were amongst them; and I dare be bold to say, there were never such strokes given in Europe as were given that day by the Highlanders." What follows seems to partake a little of the marvellous. "Many of General Mackay's officers and soldiers were cut down through the skull and neck to the very breast; others had skulls cut off above their ears like night-caps; some soldiers had both their bodies and cross-belts cut through at one blow; pikes and small swords were cut like willows; and whoever doubts of this may consult the witnesses of the tragedy." The whole, indeed, seems to have been, in more senses than one, a very *cutting* affair.

he was created vice-chamberlain, an office which he held for twenty-two years. Killigrew died in 1693, four years after the Revolution. He was the author of four plays, printed at Oxford, 1666, in folio, and which have been commended by some eminent judges of dramatic merit, particularly by Waller. Another play, called the Imperial Tragedy, 1690, in folio, is also ascribed to him; and a little poem of his, set to music by Henry Lawes, is likewise extant. Wood informs us that, in his declining age, after he had retired from court, he wrote The Artless Midnight Thoughts of a Gentleman at Court, 1684, in 8vo, the second edition of which he dedicated to Charles II.; and another work, entitled Midnight and Daily Thoughts, in prose and verse, 1694, in 8vo. (A.)

KILLIGREW, *Thomas*, brother of the preceding, was born in 1611, and also distinguished for uncommon natural abilities. He was page of honour to Charles I., and afterwards groom of the bed-chamber to Charles II., with whom he had passed many years in exile. During his residence abroad, he visited France, Italy, and Spain, and was sent on a mission to Venice in August 1651. But the chief occupation of his leisure hours consisted in the cultivation of poetry and the composition of plays. Of the latter, Denham mentions only six; but it appears that he wrote nine during his travels, and two after his return, all of which were printed at London, 1664, in one vol. folio. Killigrew died in 1682, and was interred in Westminster Abbey. Possessing a vein of wild humour, to which he gave unlimited scope, he became a great favourite with Charles II., who, diverted by his sallies, paid more attention to Killigrew than to his ministers, and allowed the former access to the royal presence when that favour was denied to the latter. When he attempted to write, he was nothing. It was in conversation, and, above all, in light repartee, that he showed to advantage; being, in this respect, the reverse of Cowley, who made no figure in company, though he excelled in composition. Hence Denham, who knew them both, has thus characterised their respective excellencies and defects:

Had Cowley ne'er spoke, Killigrew ne'er writ,
Combin'd in one, they'd made a matchless wit. (A.)

KILLIGREW, *Anne*, "a grace for beauty, and a muse for wit," as Mr Wood says, was the daughter of Dr Henry Killigrew, brother of the two foregoing, and was born a little before the Restoration. She gave early indications of genius, and became eminent in the arts both of poetry and painting. She drew the Duke of York and his duchess, to whom she was maid of honour, as well as several other portraits and history pieces; and crowned all her other accomplishments with unblemished virtue and exemplary piety. Mr Dryden seems quite lavish in her praise, though Wood assures us he has said no more of her than she was equal if not superior to. This amiable young woman died of the small-pox in 1685; and, the year after, her poems were published, in a thin quarto volume.

KILLOUGH, a considerable village of Ireland, in the county of Down, pleasantly situated on the sea-shore, with a good quay, and a fine, safe harbour. Long. 5. 38. W. Lat. 54. 15. N.

KILMALLOCK, a town of Ireland, in the county of Limerick, which some centuries ago was one of the best-built inland towns of Ireland, and made a conspicuous figure in the annals of Irish warfare. Its former splendour is indicated by ruins on a pretty large scale; but, of the monasteries, churches, and other buildings, only one street entire remains, inhabited by very poor people. It is situated twenty miles south from Limerick.

KILMARNOCK, a town in Ayrshire, which is said to derive its name from the circumstance of St Marnock having suffered martyrdom there, about 350 years after Christ. It is pleasantly situated upon an almost level plain, surrounded by very beautiful scenery. Of its early history little is known, and neither in a warlike nor a monastic point of view is it at all conspicuous. Two centuries ago Kilmarnock was a mere hamlet, dependent upon the baronial castle in its neighbourhood; and, forty years ago, it consisted chiefly of a number of narrow passages and lanes. Since that period, however, it has been greatly enlarged and improved, elegant and even spacious streets having supplanted the more confined avenues. It is now well lighted with gas, possesses a somewhat modern appearance, and promises to become one of the first manufacturing towns in Scotland.

Kilmarnock received its first charter as a burgh of barony in 1591, a second in 1672; and in 1700 its magistrates purchased from its feudal lord the whole *common good* and customs of the burgh. For many years the town was distinguished for the manufacture of those broad, flat bonnets, which were so long the characteristic of the lowland peasantry of Scotland. In the year 1790, the produce of its whole manufacture amounted only to L.86,000. However, since the above date, it has made rapid advances in many branches of manufactures, and is now the principal town in Ayrshire for population, wealth, and appearance. There are about 1200 weavers, and 200 printers engaged in the printing of worsted shawls; and from 1st June 1830 to 1st June 1831 there were manufactured 1,128,000 of these shawls, the value of which is about L.200,000. At present there are 1000 persons engaged in the production of Scottish, Venetian, and Brussels carpets: the annual amount of this important branch may be about L.100,000. The annual value of the boots and shoes manufactured is L.42,000, of the bonnets L.12,000. The number of sheep and lamb skins dressed annually exceeds 140,000. There are many other branches of manufactures carried on very extensively. It unites with Dumbarton, Rutherglen, Renfrew, and Port Glasgow in returning a member to parliament, Kilmarnock being the returning burgh. The town is distant from Edinburgh sixty-four miles, Glasgow twenty-one, Ayr twelve, and is connected with Troon Harbour by a railway, the distance being nine miles. It has a market every Tuesday and Friday, and these are busily attended. The various market-places are well arranged and commodious. The trade of the place is assisted by branches of the Commercial, Ayr, and Ayrshire banks. The town has several good libraries and reading-rooms, and publishes a newspaper weekly. There is also an academy, in which are taught most of the useful and elegant branches of education. This place has likewise the advantage of an excellent observatory, furnished with good telescopes. There is a philosophical institution, and many societies of a benevolent and friendly nature. There are three established churches, six dissenters' meeting-houses, and a body of about 600 Catholics who assemble in a large hall.

Almost the only antiquity here is a monument erected to the memory of Lord Soulis, commemorating the assassination of that nobleman by one of the Boyd family. It has been lately rebuilt, and bears the inscription, "To the memory of Lord Soulis, 1444. Rebuilt by subscription, 1825. The days of old to mind I call." Within a mile north of the town stands the ruins of the Dean Castle, the habitation of the Earls of Kilmarnock, which was burned by accident in 1735. The population amounts to 18,000, having increased 10,000 during the last thirty years.

KILN, a stove used in the manufacture of various articles; or a fabric formed for admitting heat, in order to dry or burn materials placed in it to undergo such operations.

KILSYTH, a village in the southern part of Scotland. It is situated on the public road, twelve and a half miles from Glasgow, eleven and a half from Falkirk, and sixteen from Stirling. It is a straggling, irregularly built, but populous place, containing upwards of 2000 inhabitants, who are chiefly engaged in weaving for the Glasgow manufacturers. Kilsyth is a burgh of barony, with the privilege of holding five annual fairs. Besides the parish church, there is a relief meeting-house. Kilsyth is commemorated in Scottish history by having given its name to the victory which the Marquis of Montrose gained over General Baillie in the year 1645.

KILWINNING, an ancient, and now a considerable and thriving town of Scotland, in the county of Ayr. It is situated on a rising ground about two miles from the sea, three miles north-north-west of Irvine, and three north-east of Saltcoats. Kilwinning consists chiefly of one main street, with several small lanes or alleys, together with a few rows of modern houses. It depends principally on the weaving and manufacture of gauzes, muslins, and the like, for the Glasgow and Paisley markets. The parish church stands amongst the few remaining fragments of the once splendid abbey from which the town is supposed to have taken its origin. There are, besides, two dissenting meeting-houses. The population may amount to about 1500.

KIMBOLTON, a market-town of the county of Huntingdon, in the hundred of Leightonstone, 65 miles from London. It stands on a rich and fertile plain, is tolerably well built, and has a small market on Friday. It belongs chiefly to the Duke of Manchester, whose magnificent seat near it has long been celebrated, and, by its architecture, its decorations, and its paintings, is an object of great attention. It was the residence of Catherine of Aragon, after her divorce from Henry VIII. The population amounted in 1801 to 1226, in 1811 to 1400, in 1821 to 1562, and in 1831 to 1584.

KIMCHI, David, a Jewish rabbi, famous as a commentator on the Old Testament, who lived at the close of the twelfth and beginning of the thirteenth century. He was a Spaniard by birth, son of Rabbi Joseph Kimchi, and brother of Rabbi Moses Kimchi, both men of eminent learning amongst the Jews; but he excelled them both, being the best Hebrew grammarian the Jews ever could boast of. He wrote a Grammar and Dictionary of the Hebrew language, from the former of which Buxtorf compiled his *Thesaurus Linguæ Hebreæ*, and from the latter his *Lexicon Linguæ Hebreæ*. His writings have been held in such estimation amongst the Jews, that no one can arrive at any reputation in letters and theology without studying them.

KIMEDY, a town of Hindustan, in the Northern Circars, 83 miles south-west from Ganjam. Long. 84. 11. E. Lat. 18. 48. N.

KINATOOR, a small town of Hindustan, in the Carnatic, in which is a Hindu temple, 222 feet in height. Long. 79. 19. E. Lat. 18. 48. N.

KINCARDINESHIRE, or the Mearns, a county in Scotland, situated between 56. 43. and 57. 5. north latitude, and between 1. 47. and 2. 30. west longitude from Greenwich. It is bounded on the east by the German Ocean; on the north by Aberdeenshire, from which it is divided along the greater part of the boundary by the river Dee; and on the west and south by Forfarshire, from which it is divided by the river North Esk. The boundary along the shore of the German Ocean extends to thirty-two miles, being the greatest length of the county; and the greatest breadth from east to west is twenty-four miles; the superficial contents being 360 square miles, or about 243,444 English acres.

The cultivated parts of the county form three principal divisions; the Howe of the Mearns, the Coast-side, and Dee-side. The Howe of the Mearns, a continuation of the great valley of Strathmore, is divided from the Dee-side district by the Grampian Mountains, which stretch, from west to east, through the whole breadth of the county, gradually declining in elevation, until they disappear in the level ground near the sea, between Stonehaven and Aberdeen. The greater part of this district is in a state of high cultivation, and the face of the country is diversified and ornamented by thriving plantations. The ground in many places is composed of a bright-red clay, which gives the surface, when newly ploughed, a very peculiar appearance. The great road from Perth to Aberdeen through Strathmore traverses this district. The Coast-side district, from the river North Esk to Stonehaven, contains, with some intermixture of inferior ground, the most productive land in the county. The road from Montrose to Aberdeen runs through this division. Notwithstanding the vicinity of the ocean, some thriving plantations are to be seen; and, almost close to the shore, there are trees of considerable magnitude, especially at Brotherton, where a finely-terraced old garden, although within reach of the sea spray, is remarked as being one of the best and most productive in this part of the country. From Bervie to Stonehaven, a distance of ten miles, the shore is high and bold, presenting to the ocean, along the whole line, a perpendicular face of rock, from 100 to 250 feet in height. The most conspicuous of this range of rocks is Fowlsheugh, well known as the rendezvous, during summer, of innumerable flocks of sea-fowl of various kinds. In the face of the rock are various caverns, and natural arches and galleries, of great extent and magnificence. From Stonehaven northward to the river Dee the shore is also bold and rocky; but the face of the country is generally of a very inferior character to that of the same district south of Stonehaven, just described. The appearance of a great part of this tract is as uninviting as can well be imagined. In the neighbourhood of Stonehaven, however, and in some other places, part of the ground is in a state of high productiveness; and, even in the most barren and forbidding parts, great improvements have recently been made, and the progress of cultivation is such as to promise at no distant period a total change on the face of this part of the country. The Dee-side district, forming the third division of the cultivated part of the county, is situated on both sides of the Dee, and extends along the south bank of that river, from the sea westward, for about thirteen miles, and afterwards along both banks for nine or ten miles further, embracing also the valley of the Feugh. Some of the land in this district is fertile, and produces good crops; but a great part of the ground is still in little better than a state of nature, although to a considerable extent capable of, and in many places in progress towards, cultivation. In this district, trees have been planted to a greater extent than in any other part of the county, and the climate is peculiarly favourable to the growth of timber. The plantations greatly embellish the face of the country; and at many points, especially in the neighbourhood of the rising valley of Banchory, the prospect along the Dee is rich and beautiful. Plantations of firs extend in some places to the summits of the adjoining hills.

These three divisions, comprehending the more level and cultivated parts of the county, extend to about two thirds of the whole surface. The other third consists of the eastern range of the Grampian Mountains, by which the Dee-side district is divided from the Howe of the Mearns. This elevated region is exceedingly sterile and rugged; but in some of the glens through which the mountain-streams flow, there are spots of great natural beauty. On one of these spots, in a romantic situation, stands the shooting lodge of Glendye. The most prominent of the Grampian Mountains in this county are, Mount-Battock, which rises to nearly 3500 feet above t level of the sea; Clochnaben, remarkable for a protuberance of solid rock on its top, nearly a hundred feet in perpendicular height, and forming a well-known landmark to vessels at sea;[1] Kerloak, which rises nearly 1900 feet above the sea, commanding a view as far south as the Lammermuir Hills; and the hill of Fare, the scene of the battle of Carrichie, in 1562, between the Earls of Murray and Huntly, when the latter was slain.

The only streams deserving the name of rivers are, the Dee, which, as before mentioned, flows through the northern part of Kincardineshire for nine or ten miles, and forms the boundary for thirteen miles between this county and Aberdeenshire; and the North Esk, which divides Kincardineshire from Forfarshire on the south and west. The other streams are the Cowie, the Carron, and the Bervie, which fall into the German Ocean; the Luther, which joins the river North Esk; the Dye, the Avon, the Feugh, the Canny, and the Shiach, whose waters run into the Dee. These streams, although of inconsiderable magnitude, abound with trout and par; and their banks, with the adjoining braes and overhanging trees, are, in many places, highly picturesque and beautiful. There are no lakes of magnitude in this county. The Loch of Leys is the largest, being about two miles in circumference, and well stored with pike. In this lake are the ruins of an ancient edifice, built upon an artificial island, supported by piles of oak.

The wild animals found in this county are, the fox, the badger, the otter, the wild cat, the polecat, the weasel, and the hedgehog. Roe-deer are frequently found in the woods, and hares and rabbits are incredibly numerous. The muirs abound with grouse, and black game is not uncommon. Wild geese, and occasionally swans, are seen about the beginning of winter. Woodcock, snipe, wild duck, partridge, plover, curlew, heron, teal, and landrail, are common. Pheasants have been introduced, and their numbers are increasing. The sparrow-hawk and the falcon are frequently met with. There are but few reptiles. Adders are occasionally seen in the hilly districts. Seals breed in the caverns along the coast.

No coal has yet been discovered; but limestone is found in several places; at Tillywhilly, in the Dee-side district; near Fettercairn, in the Howe of the Mearns; and at Mathers, on the Coast-side; from which last place lime-shells are sold in considerable quantity, both for building and for manure. Native iron has also been found in a field at Balnakettle; and indications of iron ore are met with in various parts of the county. Granite, basalt, whinstone, sandstone, and plum-pudding stone, are the prevailing kinds of rock. Blocks of granite are scattered over the surface in the neighbourhood of the Grampians, both of a whitish colour like the granite of Aberdeen, and of a reddish colour like that of Peterhead. Part of the granite exported from Aberdeen is taken from the hill of Nigg in this county. At Stonehaven and at Laurieston, in the Coast-side district, quarries of sandstone afford excellent and durable materials for building. At Whistleberry, in the parish of Kinneff, millstones of valuable quality are manufactured from the pudding-rock found on the sea-coast. Jasper, quartz, and porphyry, are likewise found in many places; and specimens of asbestos have been found at Balnakettle. Zeolite is also found; and some of the caverns upon the shores near Stonehaven abound with stalactites. Pebbles of great variety and beauty of colour are found in many parts of the county, particularly in the parishes of Arbuthnot and St Cyrus. Scotch topazes, or cairngorums, are sometimes found in the mountain-streams of the Grampians. In the neighbourhood of Cowie, pipe-clay is dug, and sold for household purposes.

The towns and villages in Kincardineshire are more numerous than important. Stonehaven, the county town, is situated in a fine bay at the confluence of the waters of the Cowie and Carron, nearly midway between Aberdeen and Montrose, and contains upwards of 3000 inhabitants. The harbour, lately improved at an expense of L.8000, is more accessible than almost any harbour on the eastern coast. The sheriff and other county courts have been held at Stonehaven since 1660, when they were transferred by act of parliament from Kincardine, then the county town, by reason, as the act states, that in that town, "there was neither ane tolbuith, nor any house for parties to lodge into for their entertainment." Inverbervie is the only royal burgh within the county, and contains about 900 inhabitants. Johnshaven, four miles south of Inverbervie, contains a population of upwards of 1000. Laurencekirk, celebrated for its elegant manufacture of snuff-boxes, contains nearly 1400 inhabitants. Luthermuir, a manufacturing village, which has sprung up within these few years in the parish of Marykirk, has acquired a population of about 700 souls. The village of Banchory, beautifully situated on the north bank of the Dee, is rapidly increasing in size. The other villages in the inland part of the county are Drumlithie, Auchinblae, Fettercairn, Marykirk, and St Cyrus. Along the coast there are thirteen or fourteen fishing villages, inhabited by about 1500 individuals, solely supported by catching and curing fish. Of these villages, Findon is celebrated for its haddocks, prepared in a manner peculiar to this district.

The climate of Kincardineshire is different in the different districts of the county. In the mountainous parts, the weather, in winter and spring, is excessively severe. The climate in the low country has of late years been meliorated by the increase of wood and the draining of bogs and mosses, and is not inferior to the climate of other parts of Scotland in nearly the same latitude.

The elegant mansions of many of the proprietors, erected in the finest situations on their estates, and generally surrounded by trees, add much to the beauty and cheerfulness of the country. The principal country-seats are Inglismaldie, one of the seats of the Earl of Kintore; Arbuthnot House, the seat of Viscount Arbuthnot; Fasque, Mr Gladstoun; Durris, Mr Mactier; Fetteresso Castle, Mr Duff; Crathes, Sir Robert Burnett; Fettercairn House, Sir John Stuart Forbes; Drumtochty Castle, Mr Gammell; Ury, Captain Barclay; Netherley, Mr Silver; Dunnottar House, General Forbes. The farm-houses throughout the county have, during the last fifty years, been greatly improved; and many of them are not only commodious, but handsome. The steadings of offices have also of late been much improved. The mode of living, both of the landlords and tenants, corresponds with their enlarged and improved accommodation. It may be doubted, however, whether the custom, now adopted in many places, of lodging the farming servants in *bothies*, out of the family, has a tendency to add either to their comfort or good conduct.

In 1807, this county was divided amongst eighty proprietors. The number of separate estates is now eighty-three. Some of the larger estates have long been in the same families; but within the last fifty years one half of the land has changed hands, some of it two or three times. Of the present proprietors, twenty-seven are resident in the coun-

[1] "The four great landmarks at the sea,
Are Mount-Mar, Lochnagar, Clochnaben, and Benochie."

ty; the others are absentees, or only resident occasionally. Of the estates, two or three are above L.5000 of yearly rent; nine or ten above L.3000, and under L.5000; about twenty from L.1000 to L.3000; twenty-three from L.500 to L.1000; and the rest under L.500. The valued rent is L.74,921. 1s. 4d. Scots. The real rent, according to the property-tax returns in 1815, was L.94,861 sterling. Those returns, however, must have been considerably under the truth; and the real rent of the county cannot at present, according to a moderate calculation, be less than L.120,000.

The farms in the cultivated districts are in general under 200 acres in extent. Many do not extend to more than thirty or forty acres, and others are still smaller. In the hilly districts the pasture farms are necessarily of much greater extent. A considerable proportion in number of the tenants pay less than L.50 a year of rent each; but the number of small tenants will no doubt be lessened, through the operation of the act for reforming the parliamentary representation.

During the present century, agriculture in this county has made great progress. The example of improvement on a great scale was set by the late Robert Barclay Allardice of Ury, who, as stated by Sir John Sinclair, in his Statistical Analysis, "is entitled to have his name transmitted to posterity as the first, the most extensive, and the most systematical improver of land in the north of Scotland." The improvements begun in the latter part of the last century have been continued with much spirit down to the present time; and the greater part of the arable land of the county is now managed according to the most approved systems of modern husbandry, producing wheat, barley, bear, oats, peas, beans, clover, and turnips. Mangel-wurzel and ruta-baga are also cultivated. Improvements by draining, trenching, planting, and enclosing, are at present in progress on different estates to a considerable extent, especially the estate of Kingcausie, and on the extensive estate of Durris since the latter became the property of the present proprietor, Mr Mactier. Great facility has been given to agricultural improvements, by making new roads. There are now in this small county about eighty miles of turnpike road, which, with the other roads of communication, afford easy access to every part of the county. Lime, since the county was opened up by good roads, has been used as a manure to a great extent, upwards of 20,000 bolls being yearly imported at Stonehaven alone for that purpose. Both the improvement of land and the breed of stock have been encouraged by premiums given by agricultural associations. On almost every farm, the rearing and feeding of cattle is united with the raising of corn; and in some parts of the county the tenants depend more on cattle than on corn for the payment of their rents. The kinds of stock reared are the same as in the adjoining counties of Aberdeen and Forfar. The pure short-horn breed has been introduced by Captain Barclay of Ury, whose superior stock, both of cattle and sheep, is well known. In the mountainous district the pasturage of sheep is extensive, almost uniformly of the black-faced species. Pigs have of late years been fed in almost every part of the county, with advantage to the farmers. Butter and cheese, especially the former, are made to a greater extent than the home supply requires. On some farms cheese is made equal in quality to the best Stilton. The cheese made at Canterland is well known, and highly prized.

There are no extensive manufactures in Kincardineshire. At Stonehaven the woollen manufacture is carried on upon a small scale, and there are two flax-spinning mills. There are also mills for spinning flax at Bervie, Auchinblae, and Caldhame. There is an extensive whisky-distillery at Glenury; and porter and ale are brewed both at Stonehaven and Laurencekirk. Kelp is manufactured on the sea-coast. There is little direct foreign commerce, the inhabitants being supplied with articles of foreign produce through Aberdeen and Montrose. The principal articles of export are grain, potatoes, cattle, pork, butter, and eggs. Whisky and ale are also exported; and, in 1827, there was an exportation of herrings from Stonehaven, to the extent of 3500 barrels. Since that time the herring fishery has not been successfully, perhaps because not vigorously, prosecuted. The principal exportation of grain from the county is at the port of Montrose; but the exportation at the small port of Gourdon now amounts to about 20,000 quarters annually; and nearly that quantity was last year exported at Stonehaven. The principal articles of direct import are lime, coals, timber, slates, and salt. Two banking establishments have branches at the county town.

Kincardineshire contains eighteen entire parishes, and parts of three other parishes. The thirteen parishes in the south part of the county form the presbytery of Fordoun; the rest are attached to the presbyteries of Kincardine O'Neil and Aberdeen. The places of worship within the county are, nineteen parish churches, two chapels of ease connected with the establishment, four chapels of the Scotch Episcopal communion, three of the United Associate Synod, three of the Congregational Union, one of the Berean communion, one of the Wesleyan Methodists, and one Roman Catholic chapel; the last being connected with the Roman Catholic college at Blairs, where the chapel is situated. According to the returns made in consequence of the resolution of the House of Commons, 3d April 1835, the number of "examinable persons" belonging to the established churches was 19,539; and of those belonging to the other religious denominations 1975. The poor of this county are supported by voluntary contributions; no legal assessment for the support of the poor has yet been made.

The county of Kincardine, before the union, returned two members to parliament; it now returns one member. The number of voters forming the constituency, according to the corrected lists of 1835, is 910, of whom seventy-two are freeholders from the old roll, forty county proprietors not formerly enrolled, 581 agricultural tenants, 195 town and village proprietors and householders, ten parochial clergymen, and twelve parish schoolmasters. In conjunction with Forfarshire, this county furnishes a regiment of militia, and it raised by itself a regiment of local militia, containing 816 men. Along the coast there are three preventive or coastguard stations, with suitable accommodation for the officers and men, erected by government. Smuggling, formerly prevalent to a considerable extent, is at present unknown.

Amongst the remains of antiquity in Kincardineshire, the most conspicuous is Dunnottar Castle, formerly the principal seat of the earls marischal, now an extensive ruin. It is built on a high peninsular rock, projecting into the German Ocean, about a mile south from Stonehaven. The regalia of Scotland were deposited in this castle for safety in the time of the commonwealth. The ruins of the Castle of Fenella, with the remains of a vitrified wall, are still to be seen near Fettercairn. Part of the Kame of Mathers, an ancient place of strength, pitched like an eagle's nest on the point of a projecting rock, in the parish of St Cyrus, still remains for the inspection of the lover of antiquity. Green Castle, Whistleberry Castle, the Castle of Morphie, the Castle of Kinneff, the Thane of Cowie's Castle, and the Castle of Kincardine, are yet pointed out to visitors, or rather, in regard to some of them, the ground on which they stood, for the vestiges of these edifices are now nearly obliterated. Near the mansion-house of Fordoun are to be seen the remains of a Roman camp. In the vicinity of Stonehaven, traces of a Roman encampment are also observable; and at Raedykes, about three miles inland, an ancient camp, whether Roman or Caledonian it is difficult to say, is distinctly marked by an extensive foss, and wall or embankment. Here was dug up some years ago a chariot wheel composed entirely of massive iron. On the hill of Garvock is pointed out the Sheriff's Kettle, where the sheriff of the Mearns was boiled in a caldron by certain of the barons of the county, in the reign of James I. Druidical circles of rude stones are also to be seen at Auquhorthies, and on the hill of Garrol, upon the estate of Durris.

Amongst the celebrated writers connected with this county may be mentioned Dr Arbuthnot, Barclay, the author of the Apology, Bishop Burnett, Lord Monboddo, Dr Reid, and Dr Beattie.

The population of the county in 1811, 1821, and 1831, is shown in the following table. The total population in the last-mentioned year amounted to 31,431, of which number the towns and villages contained nearly one third. In 1831, the agricultural male servants were 2147 in number; other male servants 109, and female servants 2246. The population from 1801 to 1811 increased at the rate of four per cent.; from 1811 to 1821, at the rate of five per cent.; and from 1821 to 1831, at the rate of eight per cent.

YEAR.	HOUSES.			OCCUPATIONS.			PERSONS.		
	Inhabited.	By how many Families occupied.	Uninhabited.	Families chiefly employed in Agriculture.	Families chiefly employed in Trade, Manufactures, or Handicraft.	All other Families not comprised in the two preceding classes.	Males.	Females.	Total of Persons.
1811	5718	6349	283	3071	2059	1219	12,580	14,859	27,439
1821	5894	6685	213	3025	2301	1359	13,540	15,578	29,118
1831	6272	7136	217	2876	2281	1879	15,016	16,415	31,431

KINCARDINE, a considerable and thriving town in the southern part of Perthshire, situated on the shore of the Frith of Forth, at the distance of five miles east from Alloa, four west from Culross, ten from Dunfermline, and twenty-two from Perth. Formerly there were a number of salt-works here, and at one time this place was called West Pans; but the manufactories are now gone, and the name is out of use. The houses of Kincardine are well built, but the streets are narrow and irregular. The seaport is one of the most thriving on the Forth, having now a good quay and harbour, and there being a considerable trade in the building of vessels, chiefly for coasting. There are upwards of fifty ship-owners, amongst whom a company has been formed for mutual insurance of their vessels, thus affording protection against individual loss at sea. In the town there are works for making sails and ropes, and a brewery. Distillation is carried on at Tulliallan, in the neighbourhood. Kincardine is a burgh of barony, under the government of several bailies. A fair is held here on the last Friday of July. The established church is at Tulliallan, but there is a dissenting meeting-house in the town. The population in 1821 amounted to 2500, and in 1831 to 1887.

KINDRED, in *Law*, persons related to one another, of whom the law reckons three degrees or lines, viz. the descending, ascending, and collateral line.

KINETON, a market-town of the county of Warwick, in the hundred of Kington, eighty-four miles from London, situated at the foot of Edgehill, where a battle was fought between Charles the First and the parliament army. The market is held on Tuesday. The inhabitants amounted in 1801 to 779, in 1811 to 800, in 1821 to 782, and in 1831 to 820, making, with the annexed chapelry of Combrook, 1102.

KING, a monarch or potentate who rules singly over a people. Camden derives the word from the Saxon *cyning*, which signifies the same thing; and that from *can*, power, or *ken*, knowledge, with which every monarch is supposed to be invested. The Latin *rex*, the Scythian *reix*, the Punic *resch*, the Spanish *rey*, and French *roi*, come all, according to Postel, from the Hebrew ראש, *rosch*, signifying chief, head. Kings were not known amongst the Israelites till the reign of Saul. Before his time they were governed at first by elders, as in Egypt; next by princes of God's appointment, as Moses and Joshua; then by judges till the time of Samuel; and lastly, by kings. Most of the Grecian states were governed at first by kings, who were chosen by the people to decide differences, and to execute a power which was limited by laws. They commanded armies, presided over the worship of the gods, and executed other functions. This royalty was generally hereditary; but if the vices of the heir to the crown were odious to the people, or if the oracle had so commanded, he was cut off from the right of succession; yet the kings were supposed to hold their sovereignty by the appointment of Jupiter. The ensign of majesty was the sceptre, which was made of wood adorned with studs of gold, and ornamented at the top with some figure, commonly that of an eagle, as being the bird of Jove. At first Rome was also governed by kings, who were elected by the people, with the approbation of the senate and concurrence of the augurs. Their power extended to religion, the revenues, the army, and the administration of justice. The monarchical form of government subsisted 244 years in Rome, under seven kings, the last of whom was Tarquinius Superbus. Amongst the Greeks the king of Persia had anciently the appellation of the Great King; the king of France now has that of the Most Christian King, and the king of Spain has that of Catholic King. The king of the Romans is a prince chosen by the emperor, as a coadjutor in the government of the empire. The king of England, by the Lateran council, held under Pope Julius II., had the title of *Christianissimus* conferred on him; and that of Defender of the Faith was added by Pope Leo X. though it had been used by them some time before. The title of Grace was first given to our kings about the time of Henry IV., and that of Majesty was first bestowed on Henry VIII., before whose time our kings were called Grace, Highness, and the like. In all public instruments and letters, the king styles himself *nos*, we; though till the time of King John he employed the singular number. The definition of king above given is according to the general acceptation of the term. It will not therefore strictly apply to the sovereign of Great Britain. The power of our king is subject to great limitations; but these are the limitations of wisdom and the sources of dignity, being so far from diminishing his honour, that they impart an additional glory to his crown.

The oath taken by the king at his coronation is conceived in these terms:—"*The archbishop or bishop shall say,* Will you solemnly promise and swear to govern the people of this kingdom of Britain, and the dominions thereto belonging, according to the statutes in parliament agreed, and the laws and customs of the same? *The king or queen shall say,* I solemnly promise so to do. *Archbishop or bishop.* Will you to the utmost of your power cause law and justice, in mercy, to be executed in all your judgments? *King or queen.* I will. *Archbishop or bishop.* Will you, to the utmost of your power, maintain the laws of God, the true profession of the gospel, and the Protestant reformed religion established by the law? And will you preserve unto the bishops and clergy of this realm, and to the churches committed to their charge, all such rights and privileges as by law do or shall appertain unto them, or any of them? *King or queen.* All this I promise to do. After this the king or queen, laying his or her hand upon the holy gospel, shall say, The things which I have here before promised, I will perform and keep, so help me God; and then shall kiss the book." This is the form of the coronation oath, as it is now prescribed by law. The principal articles appear to be at least as ancient as the Mirror of Justices, and even as the time of Bracton; but the wording of it was changed at the Revolution, because, as the statute alleges, the oath itself had been framed in doubtful words and expressions, with relation to ancient laws and constitutions at that time unknown. See ENGLAND.

KING at Arms, or *of Arms,* is an officer of great antiquity, and anciently of great authority, whose business it is to direct the heralds, preside at their chapters, and exercise the jurisdiction of armoury. In England there are three kings of arms, namely, Garter, Clarencieux, and Norroy.

The *Garter principal KING of Arms* was instituted by Henry V. His business is to attend the knights of the garter at their assemblies, to marshal the solemnities at the funerals of the highest nobility, and to carry the garter to kings and princes beyond the sea; on which occasion he used to be joined in commission with some principal peer of the kingdom.

The *Clarencieux KING at Arms* is so called from the Duke of Clarence, to whom he first belonged. His office is to marshal and dispose the funerals of all the inferior nobility, as baronets, knights, esquires, and gentlemen, on the south side of the Trent.

The *Norroy KING at Arms* is an officer whose duty it is to do the same thing on the north side of the river Trent.

The two last are also called *provincial heralds,* because they divide the kingdom into provinces between them. By charter they have power to visit noblemen's families, to set down their pedigrees, to distinguish their arms, to appoint persons their arms, and with the garter king to direct the other heralds.

Anciently the kings at arms were created and solemnly crowned by the kings of England themselves; but in later times the earl marshal has a special commission at every creation to personate the king.

Lyon KING at Arms for Scotland is the second king at arms for Great Britain, and he is invested and crowned with great solemnity. To him belong the publishing of king's proclamations, the marshalling of funerals, the reversing of arms, and the like.

KING's or *Lord Advocate for Scotland.* The first in this office noticed by our writers was Sir John de Ross of Mountgreenan, who was appointed advocate to King James III. about the year 1483. Till his time there does not appear to have been any permanent officer named as king's advocate, but temporary appointments for particular causes only; as was likewise the case in early times in England, where the attorneys-general were not otherwise constituted till the end of the fourteenth century. Thus, in the claim set up in the parliament of Scotland to the forfeited estates of the Earl of March, appearance was made "procuratoribus et prælocutoribus excellentissimi principis et domini nostri actoris ab uno prosequentis," 1436, c. 135; and in the prosecution for treason in parliament against the Earl of Douglas in 1455, Lancelot de Abernethie was "proloquitor domini nostri regis." It was the clerk-register that raised and prosecuted in parliament the indictment for treason against Lord Boyd, November 1469; in the process of forfeiture in parliament against the Earl of Ross, 1475, it was the lord chancellor who conducted the prosecution and led the evidence; and in a process of treason, 1479, the king asked the award of parliament "be his chanceler and advocats." As respects the court of the lord-justiciar of Scotland, which, prior to the institution of the College of Justice, was the highest court next to the parliament, and possessed of both civil and criminal jurisdiction, it is well known that the clerk of court, or justice clerk, was long the only public prosecutor.

Sir John de Ross was succeeded in the office of king's advocate by Henryson of Fordel, who continued therein from 1494 till 1507, when he was made justice-clerk in the room of Lawson of Hierigs, appointed king's advocate. Both these offices of justice-clerk and king's advocate having become vacant in September 1513, by the fall of Lawson and Henryson on the fatal field of Flodden, Wischeart of Pittarrow was nominated to both places, and he continued to hold them till his death, when the office of king's advocate was given to Sir William Scot of Bahreary and Adam Otterburn of Redhall, both lords of council. In December 1528, Bahreary was despatched to England in a diplomatic capacity; and having in consequence resigned, he was succeeded by Sir James Foulis of Colinton, a lord of the session, who, however, on the institution of the College of Justice, accepted the place of clerk-register. Otterburn then became sole king's advocate, with the privilege of pleading within the bar of the new erected court, a privilege till then unknown in our juridical practice; for heretofore all pleaded within the bar, as indeed is still the case in the court of justiciary, where much of the old common law proceedings remain to this day; and in criminal cases the bar was occupied by the prisoner, who was thence styled the *panel,* a synonyme for *bar.*

To the same period may perhaps be traced the title of Lord Advocate: for, as early as the 2d April 1573, the king's advocate is so styled;[1] and in the statute 1587, c. 115, the title is given him as his accustomed designation. It had no doubt its origin in the circumstance of his being, from the erection of the court, a lord of session. This latter circumstance may seem the more remarkable of the two, but it admits of easy explanation, and it had its parallel in the old parliament of Paris. The constitution of the court of session, like the ecclesiastical tribunals after which it was modelled, was secret, and all its deliberations took place with closed doors. Provision was therefore to be made to secure to the crown a knowledge of its proceedings. Accordingly, at the institution of the court, the king's advocate, the king's treasurer, the clerk register, and the justice-clerk, were all made lords of session; and when no

[1] Pitcairn's *Criminal Trials.*

vacant seat existed, as was the case when Henry Lauder was appointed to officiate as king's advocate during Otterburn's absence in England in 1533, or where the party was precluded from taking it "be reason of his less age," as was the case when Sir Lewis Bellenden was appointed justice-clerk in 1578, the course adopted was to issue a royal warrant to remain in court during its deliberations. Where more than one individual held the office, as was commonly the case till the time of Sir Thomas Hope, the end in view was sufficiently attained if one only had right to remain in court; and this principle, it is believed, will be found to have been acted upon.

It was in the beginning of 1626 that Hope was appointed king's advocate, along with the aged Sir William Oliphant, a lord of session. The king then also conferred on Hope the honour of knighthood; and the court of session, by act of sederunt passed at the king's desire, allowed him to plead covered. This last ordinance has been strangely misapprehended by our writers; but, as Oliphant had just been removed from the bench, and Hope had no seat on it, there seems little reason to doubt that its object was to assert and clear the equality of the king's advocate with the judges, who then usually sat on the bench with their hats on, and of the number of whom the king's advocate had till now been one. It was not a personal but an official privilege, and was accordingly, with the other honours and privileges which had been enjoyed by Hope, confirmed to his successors by the act of sederunt dated the 2d of June 1649. Hope's learning and astuteness are well known; and as he held the office for no less a period than twenty years, and at a time when the king resided permanently in England, we need not be surprised at the very large powers enjoyed by him and his successors in his high office.

When Hope was appointed king's advocate, he was also appointed advocate to the Prince of Wales; but the latter office has since been always held separate, as it ought to be. In France, the advocate for the crown was also advocate for the church; but in Scotland, since the Reformation, this has never been the case. On the contrary, when Grant of Prestongrange accepted the office of king's advocate, the General Assembly voted the offices of their procurator and clerk, then held by him, vacant by such acceptance, and filled them up accordingly. Grant, however, had held the office of procurator to the church while he was solicitor-general, as did likewise some of his predecessors; and the learned Mr Thomas Craig seems to have been at the same time procurator to the church and advocate-depute.

The office of solicitor-general seems to be of no older origin in Scotland than about two centuries ago; and it was not till the time of Charles Erskine of Tinwald, in the beginning of last century, that this officer had right to sit and plead within the bar of the inner-house; for certainly by the act of sederunt of 28th February 1662, renewed 6th November 1690, the solicitor-general and one deputy of the lord advocate were allowed to remain within "the innermost bar" of the outer-house. The advocates-depute are of much older standing, though it was not till towards the end of the sixteenth century that the office was permanent. They are now four in number, appointed to attend the several circuits, and the Glasgow winter assize. The lord advocate has also a deputy in the court of exchequer. (U. U. U.)

King, *Dr John*, a learned English bishop, born at Worwall about 1559, was educated at Westminster School and at Oxford, and appointed chaplain to Queen Elizabeth. In 1605 he was made dean of Christ Church; for several years he was vice-chancellor of Oxford; and in 1611 he was advanced to the bishopric of London. Besides his Lectures upon Jonah, delivered at York, he published several sermons. King James I. used to style him "the king of preachers;" and Lord Chief-Justice Coke often declared that "he was the best speaker in the star-chamber in his time." He died on the 30th of March 1621, and was interred in St Paul's cathedral. Soon after his death it was reported that he had died a member of the Catholic church. But the falsehood of this story was sufficiently exposed by his son Dr Henry King, who was created bishop of Chichester, in a sermon delivered soon afterwards at St Paul's Cross; by Bishop Godwin in the Appendix to his *Commentarius de Præsulibus Angliæ*, printed in 1622; and by Mr John Gee, in his book entitled The Foot out of the Snare.

King, *Dr William*, a facetious English writer, born at London in 1663, was allied to the noble families of Clarendon and Rochester. He was elected a student of Christ Church from Westminster School in 1681. He afterwards entered upon the study of law, and having taken the degree of doctor of civil law, soon acquired a considerable reputation as a civilian, and obtained great practice. He attended the Earl of Pembroke, lord-lieutenant of Ireland, into that kingdom, where he was appointed judge-advocate, sole commissioner of the prizes, keeper of the records, and vicar-general to the lord-primate of Ireland. He died on Christmas day 1712, and was interred in the cloisters of Westminster Abbey. His writings are pretty numerous. The principal are, 1. Animadversions on a pretended Account of Denmark, written by Mr (afterwards Lord) Molesworth; 2. Dialogues of the Dead; 3. The Art of Love, in imitation of Ovid *De Arte Amandi;* 4. A volume of Poems; 5. Useful Transactions; 6. An Historical Account of the heathen Gods and Heroes; and, 7. Several translations.

King, *Dr William*, archbishop of Dublin, was descended from an ancient family in the north of Scotland, but born at Antrim in the north of Ireland on the 1st of May 1650. In 1674 he took priest's orders, and in 1679 was promoted by his patron, Dr Parker, archbishop of Dublin, to the chancellorship of St Patrick. In 1687 Peter Manby, dean of Londonderry, having published at London a pamphlet entitled Considerations which obliged Peter Manby, dean of Londonderry, to embrace the Catholic Religion, our author immediately wrote an answer. Mr Manby, encouraged by the court, and assisted by the most learned champions of the church of Rome, published a reply under the title of a Reformed Catechism, in two Dialogues, concerning the English Reformation, in reply to Mr King's Answer. Our author soon rejoined in a Vindication of the Answer. Mr Manby dropped the controversy, but dispersed a loose sheet of paper, artfully written, with the title of a Letter to a Friend, showing the Vanity of this Opinion, that every Man's Sense and Reason are to guide him in Matters of Faith. This Dr King refuted in a Vindication of the Christian Religion and Reformation against the Attempts of a Letter to a Friend. In 1689 he was twice confined in the Tower by order of King James II., and the same year created doctor of divinity. In 1690, upon King James's retreat to France after the battle of the Boyne, he was advanced to the see of Derry. In 1692 he published at London, The State of the Protestants of Ireland under the late King James's Government, in 4to; "a history," says Bishop Burnet, "as truly as it is finely written." He had by him at his death attested vouchers of every particular fact alleged in this book. However, it was soon attacked by Mr Charles Lesly. In 1693, our author, finding the number of Protestant Dissenters in his diocese of Derry increased by a vast addition of colonists from Scotland, in order to persuade them to conformity to the established church, published a Discourse concerning the Inventions of Men in the Worship of God. Mr Joseph Boyse, a dissenting minister, wrote an answer.

King.

The bishop answered Mr Boyse. The latter replied, and the bishop rejoined. In 1702 he published at Dublin, in quarto, his celebrated treatise *De Origine Mali*. Mr Edmund Law, fellow of Christ's College in Cambridge, afterwards published a complete translation of this work, with very valuable notes, in 4to. In the second edition he has inserted, by way of notes, a large collection of the author's papers on the same subject, which he had received from his relations after the publication of the former edition. In this excellent treatise the author has made many curious observations. He asserts and proves that there is more moral good in the earth than moral evil. A sermon by our author, preached at Dublin in 1709, was published, under the title of Divine Predestination and Foreknowledge consistent with the Freedom of Man's Will. This was attacked by Anthony Collins, in a pamphlet entitled a Vindication of the Divine Attributes; in some Remarks on the Archbishop of Dublin's Sermon entitled Divine Predestination, &c. He published likewise a Discourse concerning the Consecration of Churches, showing what is meant by dedicating them, with the Grounds of that Office. He died in 1720. Archbishop King, as appears by his correspondence with Swift, was a man of humour, and many of his witty sayings were at one time current.

King, *Dr William*, principal of St Mary's Hall, Oxford, son of the Reverend Peregrine King, was born at Stepney in Middlesex, in the year 1685. He was made doctor of laws in 1715; became secretary to the Duke of Ormond and Earl of Arran, as chancellors of the university; and was made principal of St Mary's Hall on the death of Dr Hudson in 1719. When he stood as candidate for member of parliament for the university, he resigned his office of secretary, but retained his other preferment, and it was all he did enjoy, till the time of his death. Dr Clarke, who opposed him, carried the election; and after this disappointment, he, in the year 1727, went over to Ireland, where he is said to have written an epic poem called *The Toast*, which was a political satire, printed and given away to his friends, but never sold. On the dedication of Dr Radcliffe's library, in 1749, he spoke a Latin oration in the theatre of Oxford, which was received with the highest acclamations; but it was otherwise treated when printed, for he was attacked in several pamphlets on account of it. Again, at the contested election for Oxfordshire in 1755, his attachment to the old interest drew on him the resentment of the new, and he was libelled in newspapers and pamphlets, against which he defended himself in an Apology, and warmly retaliated on his adversaries. He wrote several other things, and died in 1762. He was a polite scholar, an excellent orator, an elegant and easy writer, and was esteemed by the first men of his time for his learning and wit.

King, *Peter*, lord high chancellor of Great Britain, the son of an eminent grocer and salter, was born at Exeter in 1669, and bred up for some years to his father's business; but his inclination to learning proved so strong that he laid out all the money he could spare in books, and devoted every moment of his leisure hours to study. He thus became an excellent scholar before the world suspected any such thing; and gave the public a proof of his skill in church history, by his Inquiry into the Constitution, Discipline, Unity, and Worship of the Primitive Church, that flourished within the first three hundred years after Christ (London, 1691, in 8vo). This was written with a view to promote the scheme of a comprehension of the Dissenters. He afterwards published the second part of the Inquiry; and having desired, in his preface, to be shown, either publicly or privately, any mistakes he might have committed, that request was first complied with by Mr Edmund Elys, between whom and our author there passed several letters upon the subject, in 1692, which were published by Mr Elys in 1694, under the title of Letters on several Subjects. But the most formal and elaborate answer to the Inquiry appeared afterwards, in a work entitled Original Draught of the Primitive Church.

Books of Kings || King's County.

His acquaintance with Mr Locke, to whom he was related, and who left him half his library at his death, was of great advantage to him. By the advice of that great philosopher, after he had been some time in Holland, he applied himself to the study of the law, in which profession his learning and diligence soon made him noticed. In the two last parliaments of the reign of King William, and in five parliaments during the reign of Queen Anne, he served as burgess for Beer-Alston in Devonshire. In 1702, he published at London, without his name, his History of the Apostles' Creed, with critical observations on its several articles; a work which is highly esteemed. In 1708 he was chosen recorder of the city of London; and, in 1710, he was one of the members of the House of Commons at the trial of Dr Sacheverel. In 1714 he was appointed lord chief justice of the common pleas; and the April following he was made one of the privy council. In 1715 he was created a peer, by the title of Lord King, Baron of Ockham in Surrey, and appointed lord high chancellor of Great Britain, in which situation he continued till 1733, when he resigned. He died at Ockham, in Surrey, in the year 1734.

Books of Kings, two canonical books of the Old Testament, so called because they contain the history of the kings of Israel and Judah, from the beginning of the reign of Solomon till the Babylonian captivity, that is, for the space of nearly six hundred years. The first book of Kings contains the latter part of the life of David, and his death; the flourishing state of the Israelites under Solomon, his building and dedicating the temple of Jerusalem, his shameful defection from the true religion, and the sudden decay of the Jewish nation after his death, when it was divided into two kingdoms. The rest of the book is occupied in relating the acts of four kings of Judah and eight of Israel. The second book, which is a continuation of the same history, is a relation of the memorable acts of sixteen kings of Judah, and twelve of Israel, and the end of both kingdoms, by the carrying off the ten tribes captive into Assyria by Shalmanasar, and the other two into Babylon by Nebuchadnezzar. It is probable that these books were composed by Ezra, who extracted them out of the public records which had been kept of what passed in that nation.

KING'S County, an inland county of the province of Leinster, in Ireland, is bounded on the north by the county of Westmeath, on the east by the county of Kildare, on the south by the Queen's county and Tipperary, and on the west by the counties of Tipperary, Galway, and Roscommon. In its greatest length from south-west to north-east it measures upwards of fifty miles, and forty-two in its greatest breadth from east to west, but the irregularity of its shape prevents the deduction of any practical inference as to its dimensions from these premises. Its actual extent is 528,166 acres, of which 394,569 are capable of cultivation, 133,349 are unprofitable mountain or bog, and not more than 248 are under water.

In the earliest periods of Irish history, this county formed part of the territory of Hy-Falgia, and was also known by the name of Hy-Laoighis, a denomination that comprehended also the Queen's county and some other districts. The southern part of it afterwards obtained the name of Ely O'Carroll. It was also known by that of the kingdom of Offaly. In the reign of Philip and Mary it was reduced into shire ground, and assumed the title it still retains, when its assize-town also took its name from the above-named king. At that time the heads of the principal clans were, the O'Conor-Falies, the O'Carrolls of Ely O'Carroll, the M'Egans, the O'Delanys, and the O'Meaghers. It is now divided into the twelve baronies of Ballyboy, Ballycowan, Ballybritt, Clonlisk, Coolestown, Eglish or Fircal, Garrycastle, Geashill, Kilcoursey, Upper and Lower Philipstown, and Warrenstown. These are again subdivided into forty-four parishes, besides seven parts of parishes, the remaining parts of which are in some of the adjoining counties.

According to former ecclesiastical arrangements of Ireland, this county comprehended parts of the dioceses of Kildare, Meath, Killaloe, Ossory, and Clonfert; but under the new distribution of the dioceses it is comprehended in those of Dublin, Meath, Killaloe, and Ferns.

The surface of the country is for the most part level and uninteresting; the great field of flœtz limestone, that forms so much of the soil of Ireland, spreading itself over all but its southern portion. Beds of foliated limestone, of a greenish hue and a large granular texture, adapted for various useful purposes, are found at Tullamore. In the south-east, the Slieve Bloom Mountains extend in a direction from north-east to south-west for twenty miles, forming the line of demarcation between the King's and Queen's counties. They are steep and craggy, and have but one opening by which they can be crossed, called the Gap of Glandine. They consist of a nucleus of clay, surrounded by sandstone, with tracts of irreclaimable bog at their base. Pure white clay, of a quartzose nature, is found in them. Croghan Hill, in the northern extremity of the county, rises above the surrounding level to the height of more than five hundred feet, clothed with verdure to its summit. It is composed of trap, conglomerate, and flœtz limestone. On those parts of its surface the basis of which is lime, the soil is extremely barren; whilst on the other parts it is peculiarly fertile, producing, from time immemorial, good crops of oats and potatoes, without manure. The difference is so marked, that the line of junction of the two formations can be traced by the verdure on the surface. Another elevation of the country, but less remarkable than that of Croghan, is the hill of Cloghan, between the river Brosna and the Slieve Bloom Mountains. Numerous and abundant springs gush from it on all sides. The minerals found here are iron in small quantities, manganese, ochre, chalk, and potters' clay. The only river that can strictly be considered as belonging to the county is the Brosna, which rises in the county of Westmeath, and discharges itself into the Shannon. This latter river forms a considerable part of the western boundary of the county. The Barrow is its boundary to the south-east, and the Boyne skirts a small portion of its north-eastern extremity. The Lesser Brosna, also a branch of the Shannon, divides the county from Tipperary. The only lake within the county is Lough Pallis, of inconsiderable dimensions. The divisional line which separates the Queen's county passes through the middle of Lough Annagh, the northern portion of which is therefore considered as belonging to the King's county. It is of inconsiderable size, not covering more than 315 acres. Lough Boura, containing 175 acres, is so shallow that it may be safely forded in summer-time.

The soil is in general either a deep moor or a shallow gravelly loam; the former is the more productive in dry seasons, the latter in moist. Limestone is abundant in most parts. The pastures, though not luxuriant, form good sheep walks; that on the more mountainous tracts has proved excellent for young cattle. In reclaimed bog, corn crops are some weeks later in ripening than elsewhere, although the natural vegetation is earlier than in the upland pastures. A considerable portion of the great bog of Allen is in this county.

The latest return of the population gives an average of one soul to every four acres, or of about one to every $2\frac{3}{4}$ acres of cultivated land. The returns of the number of inhabitants at various periods are as follow:—

1760, De Burgo	45,618
1792, Beaufort	74,500
1813, Parliamentary census	113,226
1821, Ditto	131,088
1831, Ditto	144,029

The proportion of Protestants to Catholics is about one to four; the number of dissenters is inconsiderable.

The county was represented in the Irish parliament by six members; two for the county at large, and two for each of the boroughs of Philipstown and Banagher. The boroughs were deprived of the right of returning members at the union; and as the reform act has introduced no change into the arrangements then made, the county is now represented only by two members. The state of the constituency, as affected by the various changes made since the year 1829, is shown in the following table, exhibiting the number of electors of the different rates of franchise:—

Years.	L.50.	L.20.	L.10.	40s.	Total.
1st Jan. 1829,	842	95	—	1083	2020
1st Jan. 1830,	858	127	154	—	1078
1st May 1832,	346	225	739	—	1310

The peace of the county is maintained by a constabulary force, consisting of five chief constables, forty-eight constables, and 144 sub-constables, total 197, at an expense of L.9124 per annum, being an average of forty-seven pounds each man nearly.

The number of children receiving education in public schools was, in

Date.	Boys.	Girls.	Sex unascertained.	Total.
1821,	5531	2601	—	8,132
1824–26,	5787	3929	423	10,139

Of the numbers stated in the latter return, 2064 were of the established church, 7959 Roman Catholics, twenty-two dissenters, and ninety-four whose religious persuasion was not ascertained. The total number of schools was 254, thirty of which, containing 1854 pupils, were supported by grants of public money; twenty-four, containing 1404 pupils, by voluntary subscriptions; and the remaining 200, containing 6881 pupils, were maintained by the fees of those instructed.

The crops usually raised are, wheat, oats, barley, and potatoes. Oxen are frequently employed in field labour; a mode of yoking them by the horns is much approved by some intelligent farmers, as being less irritating to the animal, and giving a better direction to its powers. Green crops are very general; rye-grass is much encouraged for early feeding. Great attention is paid to the rearing of horses, in consequence of which the county can boast of a fine breed. The uplands and moors are chiefly employed in feeding young cattle and sheep. The wool of these latter is highly esteemed at Ballinasloe. In the northern baronies there are many dairies, in some of which cheese of a good quality is made. Lime, and limestone gravel, either by itself or formed into a compost with the gatherings of the farm refuse, constitute the general manure. The gravel burned in heaps, with the parings of the moors, produces very heavy crops. Bog stuff is also often used for manure.

There is every reason to suppose that the greater portion of this county was once an uninterrupted forest. Wherever the timber is protected it grows up to great size and beauty. The parts bordering upon Tipperary are richly wooded. Alder is indigenous. The ash grown here is preferred to any other by the Dublin workmen. The bogs furnish an inexhaustible supply of fuel, not only

King's County.

from their own peculiar vegetation, but from the trunks and roots of trees raised from them, which produce a quick and lively fire. Notwithstanding the great prevalence of bog, the general surface of the land is of considerable elevation, affording great facilities for conducting the superfluous moisture to the rivers which intersect the country in all directions. The fences are generally of white thorn, which thrives remarkably well here.

The condition of the peasantry, though more comfortable than in some other parts of Ireland, is notwithstanding low in comparison with that of the English of the same class. The houses are small and poor, mostly covered with thatch, and seldom weatherproof. Earthen walls and straw roofs are preferred by most, not only from habit, but as being warmer than stone and slate. Fuel is everywhere plentiful, the bogs furnishing an inexhaustible supply of excellent quality. The food, in general, is potatoes and oatmeal; bearmeal is used in some parts. In Kilcoursey, most of the cottiers' families consume a bacon pig annually. The peasantry are industrious when excited by what they deem adequate remuneration. The young men frequently leave home in quest of employment, rather than work for wages which they consider as too low. The women are remarkable for their industry, insomuch that youths of provident habits who reside elsewhere, frequently come hither in quest of wives. Besides their household occupations, the women prepare the materials for the manufacturer. The desire for education is sufficiently indicated by the number of small schools. Irish and English are indifferently spoken, though, in the intercourse of the lower classes with each other, the former is preferred.

The only manufactures carried on are those of wool and linen; but the quantities wrought are merely sufficient for the home consumption. The Grand Canal, which crosses the county from east to west, affords a cheap and expeditious mode of conveying its superabundant produce to other parts. Breweries and distilleries absorb most of the grain raised in the county.

Remains of antiquity of very remote date are frequent. In the Slieve Bloom Mountains there is a large pyramid of white stones, called the Temple of the Sun, or the White Obelisk. Of Danish raths, which are numerous, the most remarkable is that in Finglas parish. A chain of moats, chiefly situated at the passes of the bogs, may be traced throughout the county. At Clonmacnois are two round towers and several stone-crosses. This sequestered spot was the site of several places of religious observance, whence its name of the Seven Churches. It was also a bishop's see, which merged in that of Meath in 1568. There were three religious houses at Killeigh. Monasteroris Monastery, founded by one of the Bermingham family, in the district called Thotmoy, was a place of great repute. Durrow was also the site of an extensive abbey. The remains of military antiquities are still more numerous. Rathmore Castle, the area of which comprehended two acres, is looked upon as the oldest in the county. At Banagher are the remains of a fortress which commanded an important pass over the Shannon. Birr or Parsonstown Castle, formerly the residence of the O'Carrols, having fallen into the hands of the Parsons family, is now the residence of Lord Ross. Cangor Castle, in Clonlisk barony, is noted for its defence against the Irish, by whom it was ultimately taken and burned, and its garrison put to the sword.

The population is mostly rural. The towns are few and small. Philipstown, where the assizes are held, had but 1454 inhabitants at the period of the census of 1831. It is a market and post town, and is situated on the line of the Grand Canal, though it has not derived any commercial advantage from its proximity to that line of communication. The town was visited by Philip II. king of Spain, who lodged in Forth Castle, now a gentleman's seat. It is well built and paved. Its public edifices are, a church, a Roman Catholic chapel, court-house, jail, and barracks, as also a school on the foundation of Erasmus Smith. The place was formerly the site of Dingan Castle, the residence of the O'Conors, who were driven from it in 1546 by Sir William Bellingham, and forced to fly to Connaught. The town was taken and burned by King James's forces in 1690.

Parsonstown has lately risen from an obscure village to the rank of a populous, well-built, and thriving town, the resort of many families of respectability. The church is an elegant modern building of the Gothic style. In the town is a pedestrian statue of the Duke of Cumberland, who commanded the English army in 1745. Its population is 6594. The numbers of inhabitants in each of the other towns whose population exceeds 1000 souls are as follow: Banagher 2641, Shinrone 1287, Edenderry 1283, Clara 1149, and Frankfort 1112. Tullamore, on the river Clodagh, owes its present improved condition chiefly to the spirit of the inhabitants, who have taken advantage of the Grand Canal, which passes by it, in order to make it an emporium of considerable inland trade; but also in some degree to a conflagration which destroyed most of the mean and ruinous huts of which before it chiefly consisted. Its principal building is the parish church, an elegant modern structure. It contains 6342 inhabitants.

Kinghorn.

KINGHORN, a small burgh in Fife, which joins with Kirkcaldy, Dysart, and Burntisland in sending a member to parliament. For its constituency, see KIRKCALDY. It has charters from King Alexander III. dated 26th June 1284; from King David II. dated 2d July 1364; from King James V. dated 30th August 1541; and from King James VI. dated 12th December 1611. By these charters its privileges as a burgh, and its right to the harbours of Pettycur and Kinghorn, with its lake, lands, and mills, are confirmed. The revenue of these amounted in 1832 to L.670. They were then valued at L.13,114, and the debts upon them amounted to L.5836. 2s. 5d. The various projects for improving the harbours are mentioned in the article FORTH, and a negotiation is at present (1836) going on for their execution, by a joint-stock company. The extent of the lake of Kinghorn is about twenty imperial acres, and the length of the stream flowing from it to the sea is nearly 1000 yards. The height of the mill-sluice upon it above the level of the high-water mark is about 178 feet ten inches. Six mills were, within the last thirty years, driven by the waters flowing from it, and there might have been a seventh. There are at present upon it a meal and barley mill, and three flax spinning-mills, turning, with the aid of powerful steam-engines and their water-wheels, 3660 spindles. The other waterfalls are at present unemployed. Flax spinning is the principal trade of the town. The shipping trade, besides that of the ferry, is of little importance, consisting only of one large brig and two coasting vessels. The government of the town is vested in a provost, two bailies, a treasurer, thirteen councillors, and five police commissioners, chosen by the inhabitants, under the act 5 and 6 William IV. cap. 63. It has also five incorporated trades. The principal buildings are the town-house, erected on the site of an old Saxon building called St Leonard's Chapel, and the schools. Both buildings are from plans by Mr Hamilton of Edinburgh. The prison, with its airing ground, annexed to the town-house, is, with the exception of the jails at Kirkcaldy and Cupar, the best in the county. The schools belong to the burgh, but were erected by private subscription; and the gardens were gratuitously laid out chiefly by the working classes. The principal teacher is chosen by the burgage and land-ward heritors; the burgage heritors pay half of his salary, and the landward heritors the other half. There is an infant school-room, a geological museum and library-room, and a drawing school-room, within the buildings. Upwards of an acre of ground is laid out with shrubbery, and the borders of the walks contain a selection of plants, arranged with tallies bearing their names, and classes, and orders; a portion of the ground forms a bowling-green, and another contains the usual erections for gymnastic exercises. Besides the parish church, there is in the burgh an Associate Secession meeting-house and a Baptist chapel, both of which are well attended. This little town, from its ample revenue and increasing trade and population, bids fair soon to become one of the most prosperous in the county. Much has been done within the last ten years in opening up streets and removing ancient deformities; .and the operations at present in progress, under the police commissioners, to carry water in pipes through all the streets, and to light them with gas, will add further to the comfort of its inhabitants. Population in 1831, 2579.

KINGHORN *Ferry* (see FORTH). This has been a public ferry from the earliest period of Scottish history. By an act of parliament passed in 1474, the freight for the portage of man and horse at Kinghorn was to be six pennies Scotch, and for the man separately two pennies Scotch. In 1551, parliament raised the freight for the portage of the man and horse to twelve pennies Scotch, and for the man separately to six pennies Scotch; and also provided that the ferrymen were never to charge more, under pain of death, and confiscation of all their goods. On the 20th of May 1800, the ferrymen were allowed by the justices at their quarter-sessions to charge passengers, of freight ninepence sterling for the best seats in their boats, and sixpence for the seats before the mast. At present (1836) the freights of passengers are as high as two shillings sterling for the best and eighteenpence for the inferior sittings on board the steamers navigating these ferries.

KINGSBRIDGE, a town of the county of Devon, in the hundred of Stanborough, 207 miles from London. It stands at the mouth of Salcomb River, over which is a bridge. It has a good market, which is held on Saturday, is neat and well built, and has a grammar-school endowed. The inhabitants amounted in 1801 to 1117, in 1811 to 1253, in 1821 to 1430, and in 1831 to 1586.

KINGSBURY, a large parish of the county of Somerset, in the hundred of East Kingsbury, 128 miles from London. It is chiefly agricultural, with some few linen manufactures. The inhabitants amounted in 1801 to 1134, in 1811 to 1181, in 1821 to 1470, and in 1831 to 1695.

KINGSCLERE, a town of the county of Hants, in the hundred of the same name, fifty-four miles from London. There is a good market, which is held on Tuesday. The chief trade is in malting for the London brewers. The inhabitants amounted in 1801 to 1939, in 1811 to 1863, in 1821 to 2296, and in 1831 to 2532, and with the chapelries of Ecchinswell and Sidmonton, 3151.

KING'S-LANGLEY, a town of the hundred of Dacorum, in the county of Hertford, twenty miles from London. It stands near the river Colne, and was formerly the residence of Henry III. The inhabitants amounted in 1801 to 970, in 1811 to 1108, in 1821 to 1242, and in 1831 to 1423.

KING'S-NORTON, a parish of the county of Worcester, in the hundred of Halfshire, 116 miles from London. It is on the Stratford-on-Avon Canal, four miles from Birmingham, and participates in some branches of the trade of that town. It has now no market, though one was formerly held. The inhabitants amounted in 1801 to 2807, in 1811 to 3068, in 1821 to 3651, and in 1831 to 3977.

KINGSTANLEY, a town in the county of Gloucester, in the hundred of Whitestone, 105 miles from London. It was formerly a borough, and anciently the residence of the Saxon king of Mercia. The inhabitants amounted in 1801 to 1434, in 1811 to 1722, in 1821 to 2269, and in 1831 to 2438.

KING'S-TEIGNTON, a town of the hundred of Teignbridge, in the county of Devon, 185 miles from London. It is chiefly agricultural. The inhabitants amounted in 1801 to 856, in 1811 to 1001, in 1821 to 1131, and in 1831 to 1288.

KINGSTON, a town of the hundred of the same name, in the county of Surrey, ten miles from London. It is sometimes called, to distinguish it, Kingston-on-Thames, as it is situated on the right bank of that river, over which there is a handsome bridge, lately erected. It is one of the three county towns of Surrey. The spring assizes are held at it, as well as the sessions; and there is a large county jail. It is a corporate town, governed by bailiffs, a recorder, and justices. Formerly two members were returned to parliament. This place is supposed to have been the residence of one of the Saxon kings, and to have derived its name from that circumstance. There is but little trade except that of making malt, but there is a good market on Saturday. The inhabitants amounted in 1801 to 3793, in 1811 to 4144, in 1821 to 4908, and in 1831 to 5989.

KINGSTON, the capital of Jamaica. See JAMAICA.

KINGSTON, a town of Upper Canada, is advantageously situated on the northern bank of Lake Ontario, at the head of the river St Lawrence, and is separated from Points Frederick and Henry by a bay which extends a considerable distance to the north-west beyond the town, where it receives the waters of a river flowing from the interior. Point Frederick is a long, narrow peninsula, extending about half a mile into the lake in a south-easterly direction, distant from Kingston about three quarters of a mile, on the opposite side of its bay. This peninsula forms the western side of a narrow and deep inlet, called Navy Bay, from its being the chief harbour of the British navy on Lake Ontario. The extremity of the point has a strong battery, and there is a dock-yard with storehouses, and the like. Point Henry, forming the eastern side of Navy Bay, is a high, narrow, rocky ridge, extending into the lake, and crowned by a fort built on its extremity. The dock-yard, storehouses, slips for building ships of war, naval barracks, wharfs, and the like, are on an extensive scale, and in a very short period of time a formidable fleet could be equipped at this place. Next to Quebec and Halifax, Kingston is the strongest town in British America; and, with the exception of the former city and Montreal, it is the first in commercial importance. It has risen rapidly of late years, by becoming, through the means of the Rideau Canal, the main entrepôt between the trade in the lower province and all the settlements on the great lakes to the westward; and, from the measures now in progress to render the St Lawrence navigable between Montreal and Lake Ontario, it may be expected to increase yet more rapidly. The town is regularly laid out, whilst many of the houses are built of stone, and are both spacious and commodious. The public buildings are, a court-house, a government-house, a jail, an hospital, and several churches, besides the garrison, naval depôt, and other places already mentioned. The harbour, which is one of the best on the lake, is well sheltered and convenient; and here, from the commencement of spring till the latter end of autumn, great activity prevails. In 1828 the population of Kingston was 3528, and in 1834 it had risen to nearly 6000.

KINGSTON-UPON-HULL. See HULL.

KINGSWINTON, a town of the county of Stafford, in the hundred of Stourbridge, 124 miles from London. It is connected by canal navigation with the chief ports of the kingdom, and has become populous and opulent by its manufactures of glass and pottery. The inhabitants amounted in 1801 to 6464, in 1811 to 8267, in 1821 to 11,022, and in 1831 to 15,156.

KINGTON, a town of the county of Hereford, in the hundred of Huntington, 155 miles from London, with a good market on Wednesday. It stands on the river Arrow, is well built, and has a good free-school, and some trade in woollen goods. The inhabitants amounted in 1801 to 1424, in 1811 to 1617, in 1821 to 1980, and in 1831 to 2147.

KINROSS-SHIRE, a county in Scotland, bounded on the north-east, east, and south by the county of Fife, and on the north and west by Perthshire, is about twelve miles in length from east to west, and ten miles in breadth from south to north; but, according to the latest survey, contains only seventy-eight square miles, or 49,920 English acres, being one of the smallest counties in Scotland. Kinross, the county town, situated nearly in the centre, is in north latitude 56. 15. and west longitude from Greenwich 3. 10.

Kinross-shire is the highest level ground in the peninsula formed by the Forth and the Tay, which was formerly called Ross, or the promontory, and included the counties of Fife, Kinross, and Clackmannan. From this county the waters flow in every direction. The greater part of the soil is dry, resting on gravel; but part of it is damp, resting on till, with considerable fields of moss and muir. The whole has been very much improved of late. The productive land may extend to 30,000 acres, or about three fifths of the whole. The only lake it contains worth noticing is Lochleven, which is in the vicinity of Kinross. This lake was originally about fifteen miles in circumference, and covered an area of 3308 acres; but, by a recent drainage, ground to the extent of about 900 acres has been laid dry, and is in the course of being improved. It abounds in trout of excellent quality, pikes, perches, and eels. There are several islands in it, all of which have been enlarged by the drainage. On one of these, about four acres in extent, stands the Castle of Lochleven, in which Queen Mary was confined; and another, called St Serf's Island, extending to about sixty acres, contains the ruins of a monastery. Several rivulets flow into this lake, of which the principal are the Gairny, the South Queich, and the North Queich; and the river Leven, the only stream of any note in the district, issues from its eastern extremity, and, after passing through a considerable part of the county of Fife, enters the Frith of Forth at the town of Leven. The prevailing rocks are whinstone, sandstone, and limestone. Coal has been found on the estate of Blair-Adam; it is wrought at Kelty, in the parish of Cleish, on the southern boundary of the county.

Kinross-shire is divided into a number of small estates. Only about ten proprietors hold of the crown; the others hold of these freeholders, the lands having been feued out to them, for the most part, about the end of the seventeenth and beginning of the eighteenth century, for payment of a feu-duty. Hence, over the greater part of the county, every single farm is a separate property, possessed for the most part by its owner. The valued rent is L.20,250. 4s. 3d. Scots, and the real rent, according to the *Agricultural Survey*, published in 1814, was L.14,541. 10s. sterling; but it is now much increased, and cannot be taken at less than nearly double that sum. In 1811, the number of freeholders was only fifteen. When the land is let out to tenants, the leases are from fourteen to twenty-one years, except in the neighbourhood of the villages, where they are for a shorter period; and the rent is paid in money, the amount being in some instances regulated by the fiars. The size of the farms is from 100 to 300 acres. A fair proportion of them is in grass, for which both the soil and climate are favourable; and much of the land is enclosed either with stone-walls or hedges. The principal corn crops are oats and barley; wheat, though partially cultivated, does not enter into the regular course of cropping. Potatoes, turnips, and clovers, with rye-grass, are raised in every part of the county. On the banks of the Leven and the Gairny there were formerly meadows of considerable extent; but these have been drained and cultivated, and now form very productive land. The pastures of the cultivated land are occupied by cattle. Sheep are kept in numbers only on the Cleish Hills, and on that part of the Ochills which belongs to this county. Not much of the district is under wood. The most considerable plantations are on Blair-Adam, the estate of Lord Chief Commissioner Adam, and they are for the most part in a very flourishing state.

Besides Kinross the county town, and Milnathort, this county contains several villages. In 1831, Kinross contained a population of about 2400, and Milnathort about 1600. At both these places several annual fairs are held; and a weekly market for the sale of grain is held in the latter. Little manufactures are to be found here; the weavers are employed by the manufacturers of Glasgow. Assessments are resorted to for the poor of the villages, but those of the country parishes are relieved by voluntary contributions.

Kinross-shire sends a member to parliament along with the county of Clackmannan. Both counties are under the jurisdiction of one sheriff, who has a substitute for each. There are only four entire parishes, viz. Cleish, Orwell, Kinross, and Portmoak, with portions of other three; the first three belong to the presbytery of Dunfermline, and the fourth to that of Kirkcaldy, both under the jurisdiction of the synod of Fife. The population in 1811, 1821, and 1831 is given in the annexed abstract. By the returns for the first of these years, there were about ninety-three inhabitants to the square mile.

YEARS.	HOUSES.			OCCUPATIONS.			PERSONS.		
	Inhabited.	By how many Families occupied.	Uninhabited.	Families chiefly employed in Agriculture.	Families chiefly employed in Trade, Manufactures, or Handicraft.	All other Families not comprised in the two preceding classes.	Males.	Females.	Total of Persons.
1811	1364	1680	53	428	640	612	3466	3779	7245
1821	1419	1827	34	446	735	646	3660	4102	7762
1831	1524	2019	43	440	819	760	4519	4553	9072

See *Beauties of Scotland*, vol. iv.; *General Report of Scotland*, vol. i.; Playfair's *Geographical and Statistical Account of Scotland*, vol. i.; Dr Graham's *General View of the Agriculture of Kinross and Clackmannan*; and, for its antiquities, Sibbald's *History of Fife and Kinross.*

KINSALE, a town of Ireland, in the county of Cork, is situated on a bay at the mouth of the river Bandon, which forms a fine harbour called the harbour of Kinsale. The town, being built upon the side of a hill, presents a fine prospect; but, on entering it, the streets are found to be narrow, and the communications difficult, from the steepness of its declivities. It was much more frequented than Cork by the early English monarchs, who bestowed on the place extensive privileges, and viewed it as the key of southern Ireland. It has now, however, sunk under the superior importance of its neighbour. Its port is comparatively little frequented, except as a watering place; but a considerable fishing trade is carried on. Kinsale underwent two sieges, one in the time of Elizabeth, and another in that of William. James II. also landed here on his arrival to recover his throne. The town gives the title of baron to the head of the De Courcy family, who enjoys the singular right of appearing covered in the presence of royalty. The population amounts to 7688.

KINZIG, one of the six circles into which the grand duchy of Baden is divided. It extends over 543 square miles, comprehending twenty-seven cities and market-towns, 180 villages, and 518 hamlets, with 198,500 inhabitants. About two thirds of the population adhere to the Catholic church, and the remainder are chiefly Lutherans. The greater part of the circle consists of the most lofty parts of the Black Forest; but between the hills, in which many rivulets and rivers run, there are some beautiful and fruitful valleys, which are well cultivated. The circle yields more corn than is wanted for consumption at home. The wine is of moderate quality, and, in some of the districts, excellent. The chief articles which are exported are corn, wood, hemp, flax, tobacco, straw-plat, and many wooden clocks, on the last of which great ingenuity is displayed. The circle is divided into fifteen bailiwicks. The capital is Offenburg. The name is derived from the river Kinzig, which falls into the Rhine.

KIPPIS, Andrew, a learned and eminent English nonconformist divine and biographer, was born at Nottingham, on the 28th of March 1725. On the death of his father, he was, at the age of five, removed to Sleaford, in Lincolnshire, where he received his grammatical education, and gave such early proofs of talents and progress as attracted the notice of Mr Merrivale, the pastor of a congregation of dissenters at that place. To this excellent man it was probably owing that young Kippis directed his views to the profession of a dissenting minister, and to those studies in which he afterwards so much excelled. In 1741 he was placed under the tuition of Dr Doddridge in the academy at Northampton, a seminary at that time in high reputation. Of the advantages which this institution afforded him Mr Kippis knew how to make the best improvement; and his regular conduct and proficiency secured him the esteem of his excellent tutor. Having completed his course of studies in five years, he was invited to a dissenting congregation at Dorchester; but he gave the preference to a similar call from Boston, in Lincolnshire, in 1746, where he remained till 1750, removing from thence to Dorking, in Surrey, and, two years afterwards, to Long Ditch, Westminster, in the room of Dr Hughes, deceased. This was in October 1753; in the preceding month he had married Miss Elizabeth Bott, the daughter of a merchant at Boston.

The situation, for which Mr Kippis was eminently qualified by his extensive abilities, being now respectable, introduced him to useful and honourable connections. He became a manager of the presbyterian fund for assisting poor congregations in the country in supporting their ministers; and in 1762 he was chosen a member of Dr Williams's trust, for nearly similar purposes, together with the doctor's valuable library, which afforded him opportunities of very extensive usefulness. In 1762, he signified amongst his friends his design of taking private pupils, and was on the eve of entering into engagements with the parents of two or three young gentlemen, when a more honourable though less lucrative employment was offered him. He was appointed classical and philological tutor in Coward's academy, an office which he filled for upwards of twenty-five years, with uncommon reputation to himself, and unspeakable advantage to his students. He received the degree of doctor of divinity from the university of Edinburgh, by the unsolicited recommendation of the learned Professor Robertson, in 1767; in 1778 he was made a member of the Antiquarian, and in 1779 a fellow of the Royal Society.

His literary engagements having become extremely numerous, he was, in 1784, obliged to resign his appointment in Coward's academy, which was discontinued in the subsequent year. In 1786, attempts were made to establish a new academy in the vicinity of London, a design which Dr Kippis exerted all his influence to accomplish; and although his numerous engagements made it extremely difficult for him to fill any department in it, he reluctantly yielded to the wishes of the subscribers, and became a tutor. But the inconvenience arising from the distance of Hackney from his place of residence induced him to resign that office in a few years. His professional duties and private studies occupied his time after this period; and as he enjoyed an uninterrupted state of good health and constitutional vigour, his friends were led to hope that his life and usefulness would be long continued; but, in consequence of a cold which he caught on a journey, he was seized with a fever which no medical skill could subdue, and he died on the 5th of October 1795, in the seventy-first year of his age.

Dr Kippis was distinguished in a high degree for those virtues and accomplishments which are universally allowed to be the chief ornaments of human nature. His temper was mild and gentle, benevolent and candid; his manners and address were easy, polished, and conciliating. Notwithstanding his great reputation, he was void of pride, vanity, and self-conceit; on the contrary, he was humble, modest, affable, and engaging. The powers and vigour of his mind were far above mediocrity; he had a sound judgment, a comprehensive understanding, correct imagination, retentive memory, a refined taste, and he could exert his faculties on any subject with the utmost facility. He was an early riser from his youth, to which his good health may in a great measure be ascribed. He excelled in his acquaintance with the classics, belles-lettres, history, and biography. He was the steady friend and advocate of genuine civil and religious liberty; and, as a divine, he was well acquainted with the different branches of theology, and with those subjects which are subservient to the critical study of the Scriptures. He very seldom introduced controverted topics into the pulpit, but confined himself to such doctrines and duties as have an immediate influence upon the temper and practice.

Of his works, which are numerous and valuable, the following are the principal: 1. Review of the Transactions of the present Reign; 2. The History of Learning, Knowledge, and Taste, in Great Britain; 3. A Vindication of the Protestant Dissenting Ministers, with regard to their late application to Parliament; 4. Considerations on the Provisional Treaty with America, and the Preliminary Articles of Peace with France and Spain; 5. The Life of Sir John Pringle; 6. Six Discourses delivered at the Royal Society, on assigning the Copley Medal; 7. The Life of Captain James Cook, of Dr Lardner, and Dr Doddridge; 8. Sermons preached on public occasions; and, 9. the Biographia Britannica. This last great work, which he did not live to finish, has assigned him a high rank amongst the learned of his country, and will transmit his name with distinction to posterity.

KIRBY-LONSDALE, a town of the county of Westmoreland, in the ward of the same name, 251 miles from London. It is a neat town, in a pleasant valley, with a market, well supplied, on Wednesday. It is situated on the Lune, a river abounding with trout and other fish. The inhabitants amounted in 1801 to 1283, in 1811 to 1368, in 1821 to 1643, and in 1831 to 1686.

KIRBY-MOORSIDE, a town of the north riding of Yorkshire, in Rydall division, 278 miles from London, with a good market on Wednesday. It derives its name from its situation at the edge of Blackmoor. The inhabitants amounted in 1801 to 1396, in 1811 to 1673, in 1821 to 1878, and in 1831 to 1802.

KIRBY-STEPHEN, a town of the county of Westmoreland, in the east ward, 265 miles from London. It is situated on the western bank of the river Eden, and consists chiefly of one long street. It has some manufactures of hosiery, but little other trade. The market is held on Tuesday. The inhabitants amounted in 1801 to 1141, in 1811 to 1235, in 1821 to 1312, and in 1831 to 1409.

KIRCHER, ATHANASIUS, a Jesuit, and one of the most learned and laborious men that this celebrated order has ever produced, was born on the 2d of May 1602, at Geysen, a small town near Fulde in Germany. His parents were humble, but respectable, and exerted themselves to give him a good education. Having finished his studies, he entered the society of the Jesuits, where he found new means of satisfying his passion for learning, and applied himself to physics, natural history, mathematics, and ancient languages, embracing with equal ardour almost every department of knowledge. Being appointed to teach philosophy, and afterwards the oriental languages, in the college of Wurtzbourg, he acquitted himself of this double duty in the most satisfactory manner. But the Thirty Years' War, having interrupted his useful labours, and disturbed his repose, forced him to quit the country where he had already distinguished himself. He retired into France, and first settled in the Jesuits' College at Avignon, where he passed two years, entirely occupied with the study of antiquities. It was during his residence in this city that he became acquainted with the learned Peiresc, who advised him to attempt the explication of the Egyptian hieroglyphics; a task to which he afterwards applied himself with great zeal, though, unfortunately, with but indifferent success. Having received an appointment to the professorship of mathematics at Vienna, he was preparing to return to Germany, when he received an order to repair to Rome, whither he accordingly proceeded without delay. In 1637, the pope charged him to accompany Cardinal Frederick of Saxony to Malta, where he was received by the grand-master of the order of knights of St John and Jerusalem with much distinction. He next visited Sicily and the kingdom of Naples, and then proceeded to take possession of the chair of mathematics in the Roman College; a situation which he filled for eight years, at the end of which he obtained permission of his superiors to discontinue teaching in order to apply himself to other pursuits. He had a dispute with Father Maignan respecting the invention of an optical instrument; but though the affair made some noise, the question of priority remained undecided. Kircher died at Rome, on the 28th of November 1680, the same day on which Bernin and Grimaldi expired. He was a man of extraordinary but ill-digested erudition, without critical judgment. He was gifted with a strong imagination, vast memory, and indefatigable patience; but, notwithstanding his persevering application, he found himself unable to verify the facts stated in his works; and he had, besides, the folly to attempt to explain everything, by which means he fell into serious errors, and his fidelity was even brought into question. For an account of his fanciful and abortive efforts to penetrate the mystery of the Egyptian inscriptions, the reader is referred to the introductory section of the article HIEROGLYPHICS in this work. Several sovereigns, and amongst these Augustus duke of Brunswick, furnished him with the sums necessary for his experiments, and also transmitted to him rare and curious articles, with which he formed one of the most valuable cabinets which had yet been seen; whilst the most distinguished foreigners who visited Rome failed not to pay their respects to the learned Jesuit. The works of Kircher are very numerous, and would merit a detailed notice; but all that is consistent with the object of this notice of his life is merely to subjoin a list of the more important. They may be divided into three classes, according as they relate to the physical sciences and mathematics, languages and hieroglyphics, history and antiquities, not to mention some smaller productions of an ascetic character, which cannot be included under any of these heads. And they are as follow, viz. 1. Ars Magnetica, sive Conclusiones Experimentales de effectibus Magnetis, Wurtzbourg, 1631, in 4to; 2. Magnes sive de arte magnetica Opus tripartitum, Rome, 1641, in 4to; 3. Magneticum Naturæ regnum, sive Disceptatio physiologica de triplici in natura rerum magnete, Rome, 1667, in 4to; 4. Ars magna Lucis et Umbræ in x. libros digesta, Rome, 1645, 1646, in folio; 5. Misurgia universalis, sive ars magna consoni et dissoni in x. libros digesta, Rome, 1650, in two vols. folio; 6. Phonurgia nova de prodigiosis sonorum effectibus et sermocinatione per machinas sono animatas, Kempten, 1673, in folio; 7. Mundus Subterraneus, in quo universæ naturæ majestas et divitiæ demonstrantur, Amsterdam, 1664 or 1668, in two vols. folio; 8. Primitiæ Gnomonicæ Catoptricæ, hoc est horologiographiæ novæ specularis, Avignon, 1633, 1635, in 4to; 9. Specula Melitensis encyclica, sive syntagma novorum instrumentorum physico-mathematicorum, Messina, 1638, in 12mo; 10. Arithmologia, sive de occultis Numerorum mysteriis, Rome, 1665, in 4to; 11. Tariffa Kircheriana, sive mensa Pythagorica expansa, Rome, 1679, in 12mo; 12. Itinerarium extaticum quo Mundi opificium nova hypothesi exponitur, Rome, 1656, in 4to; 13. Iter extaticum qui et Mundi subterranei prodromus dicitur, quo geocosmi opificium sive terrestris globi structura exponitur, Rome, 1657, in 4to; 14. Diatribe de prodigiosis crucibus quæ non pridem post ultimum incendium Vesuvii montis Neapoli comparuerunt, Rome, 1681, in 8vo; 15. Scrutinium physico-medicum contagiosæ luis quæ pestis dicitur, Rome, 1658, in 4to; 16. Ars magna sciendi seu combinatoria, in xii. libros digesta, Amsterdam, 1669, in folio; 16. Prodromus Copticus sive Ægyptiacus, in quo linguæ Coptæ sive Ægyptiacæ, quondam Pharaonicæ, origo, ætas, &c. exhibentur, Rome, 1636, in 4to; 18. Lingua Ægyptiaca restituta, sive Institutiones grammaticales et Lexicon Copticum, Rome, 1644, in 4to; 19. Obeliscus Pamphilius, hoc est Interpretatio nova, et huc usque intentata Obelisci hieroglyphici ex hippodromo Caracallæ, in forum agonale translati, Rome, 1650, in folio; 20. Œdipus Ægyptiacus, hoc est universalis Hieroglyphicæ veterum Doctrinæ, temporum injuria abolitæ, instauratio, Rome, 1652, in folio; 21. Obeliscus Chigius, Rome, 1666, in folio; 22. Sphynx mystagoga, sive diatribe hieroglyphica de mumiis, Amsterdam, 1676, in folio; 23. Polygraphia, 1680; 24. Historia Eustachii Mariana, Rome, 1665, in 4to; 25. China Illustrata, Amsterdam, 1667, in folio; 26. Latium, id est nova et parallela Latii tum veteris tum novi Descriptio, Amsterdam, 1671, in folio; and many other works. (A.)

KIRCHHEIM, a city of the kingdom of Wirtemburg, in the circle of the Danube, and the capital of a bailiwick

Kilow | Kirkcaldy. of its own name, which extends over seventy-eight square miles, and contains 25,200 inhabitants. The city is situated on the river Lauter, in a fruitful valley, has a respectable palace, 650 houses, and 4500 inhabitants, employed in making linen, woollen, and cotton goods, and other articles.

KIRILOW, a city of the province of Novogorod, in Russia, the capital of a circle of the same name, which extends over 579 square miles, containing two cities, 1280 villages and hamlets, inhabited by 52,870 persons. The city stands between two fresh-water lakes, and has 620 houses, with 2460 inhabitants. Long. 38. 29. E. Lat. 59. 42. N.

KIRKCALDY is a town in Fifeshire, about twelve miles from Edinburgh, lying along the margin of a bay, on the north side of the Frith of Forth. It consists chiefly of a very long and spacious street, well paved and lighted, in which there are many elegant houses and shops; also a few smaller streets and lanes, chiefly opening into the main street. To the west of the royalty, but within its boundary as fixed by the act 2 and 3 William IV. cap 65, are the populous villages of Linktown, in the parish of Abbotshill, and the village of West Bridge, in the parish of Kinghorn. In the year 1334, Kirkcaldy was mortified by David II. to the abbey of Dunfermline; and it was possessed by the abbey till the year 1450, when the commendator and monastery sold it, along with its harbour, to the bailies and inhabitants. On 5th February 1644 it acquired a charter of erection and novodamus as a royal burgh from King Charles II. By this charter he conveyed to the bailies, councillors, and community, the burgh, the harbour, and lands, the extent of which has been estimated at 487 acres. The amount of the revenue for the year ending 10th October 1835 was L.2320. 1s. 2d.; the ordinary expenditure, L.1263. 13s. $6\frac{8}{12}$d.; casual expenditure, L.24. 5s. The debts for the burgh then amounted to L.7040. 1s. $6\frac{1}{2}$d., and the effects were valued at L.1854. 18s. $3\frac{1}{2}$d. The government of the burgh is vested in a provost, two bailies, a dean of guild, and sixteen councillors, who are chosen under the act 3 and 4 William IV. cap. 76. There are also seven incorporated trades. The harbour, which is pretty safe, is situated near the east end of the town. In 1796 a basin or inner harbour was added to it; and of late years it has been very much deepened, and otherwise improved. The depth of the water at its entrance at spring tides is fifteen feet. Its basin is capable of containing fifteen sail of vessels of 350 tons and under. Its outer harbour, when the deepening operations at present (1836) in progress in it are completed, will contain considerably more. Though the harbour is the property of the town, yet, in terms of a statute passed in 1827, it is under the management of parliamentary commissioners, consisting of the provost, two bailies, dean of guild, and treasurer of the burgh, and the convener of the seven incorporated trades, three commissioners chosen by the prime guild or society of sailors, three by the merchants, and two by the county of Fife. By a decree-arbitral dated 5th March 1684, in a submission between the burghs of Kirkcaldy, Kinghorn, and Burntisland, the number of Kirkcaldy boats for transporting passengers and goods to and from Leith was limited to four. This decree was, on 20th December 1817, declared by the supreme court to be still in force; and the decision of the court further provided, that the four boats to be entitled to ply on the passage should be licensed by the magistrates and town council of Kirkcaldy. This decree-arbitral and decision of the court has had the effect of establishing a right of ferry in the town council of Kirkcaldy, which is now become one of the principal sources of the town's revenue. The ferry is at present navigated by two steamers belonging to the Kinghorn ferry-trustees, who hold licenses from the town council for that purpose. They make from two to three trips from the ferry stations, on each side of the firth, daily. About the commencement of the reign of Charles I. Kirkcaldy is said to have possessed 100 sail of vessels. Between the years 1644 and 1650, and shortly after, in the subsequent struggle with England, in less than ten years, ninety-six of its ships were said to have been taken at sea. In 1652, it appears, from Tucker's report, to have had twelve vessels, the burden of the whole of which was 582 tons. In the reports of the state of the royal burghs of Scotland made to the commissioners appointed by the general convention holden at Edinburgh, 9th July 1691, it appears that in 1692 the burden of the vessels then belonging to the port of Kirkcaldy was 1215 tons, and their estimated value was 45,200 merks. All these were then reported to be employed in carrying coals to Holland and London, except one or two, which might have freights from foreigners to the Sound or to Norway. There were also four ferry boats, of the value of 500 merks, each of which are stated to have been very unprofitable, since Kinghorn had built so many small boats, yawls, and great boats. In 1760 the trade of the port was so much depressed, that it then employed no more than one coaster of fifty, and two ferry boats each of thirty tons. The number of vessels in 1792 was twenty-six, the burden of which was 3700 tons register, and their value about L.30,000. The shipping belonging to the town in 1836 consists of seven vessels engaged in the whale fishery, eighteen in the foreign and general trade of the country, two smacks engaged in the London trade, two vessels in the trade to Newcastle, two in the Glasgow trade by the great canal, one in the Dundee trade, and two in the trade of Leith, besides two open boats. The burden of the whole amounts to about 6709 tons. There is at present a custom-house in Kirkcaldy, which includes under its superintendence all the ports from Aberdour on the west, to St Andrews on the east. On the 1st of January 1831 the burden of the whole of the vessels belonging to these ports amounted to 14,596 tons, and were navigated by 1289 seamen. There is a corn stock and sample market at Kirkcaldy, which is the most extensive in the county. It is held every Saturday, except on the third Saturday of February and July, and first Saturday of October, when it is held on the Friday preceding these days along with the horse and cattle market, which are fixed at these times. The trade of Kirkcaldy consists chiefly of flax-spinning, and weaving coarse linen goods, such as ticks, dowlas, checks, and sail-cloth, for home and foreign consumption. The value of the goods manufactured in 1815, when the trade was depressed, was estimated at L.125,981. It is now considerably increased. There are at present ten spinning-mills within the new limits of the burgh, turning upwards of 4895 spindles. There are also a rope-work, four bleachfields connected with the town for bleaching yarn, two tan-works, four salt-pans which used to make annually 15,000 bushels of salt before the salt-duties were repealed, a whisky distillery, two breweries for ale and porter, two iron founderies, and a colliery adjacent to the burgh, at which are raised annually 15,000 tons of coal. The banking business of the town is managed by branches of the Bank of Scotland, Glasgow Bank, Commercial Bank of Scotland, and National Bank of Scotland. There is a Chamber of Commerce, or association among the merchants, which was founded in 1825, for protecting the manufacturing interest, and for matters of general concern. There are a subscription library and a mechanics' library. The former, instituted about twenty-five years ago, now contains about 4000 volumes. There are also two news-rooms, maintained by public subscription. The public schools are maintained by the magistrates and council, and consist of a teacher of Latin and Greek, and a teacher of English and writing. The late Mr Philip, merchant in Kirkcaldy, who died in 1829, left from L.70,000 to L.80,000 for the purpose of educating and clothing a hundred orphan or destitute children in Kirkcaldy, a hundred and fifty in Pathhead, a hundred in Abbotshall, and fifty in Kinghorn. There is also another charity, arising from a fund left by the late John Thomson, post-master, partly for education, and partly for people in reduced circumstances. Besides the established church, there are two meeting-houses of the United Associate Synod, one of the Original Seceders, one of the Original Burgher Synod, one of the Independents, one of the Baptists, and one of the Episcopalians. The inhabitants of Kirkcaldy took a lively interest in all the civil and religious struggles under the house of Stuart. In 1622, when the general assembly of the protestant churches of France deputed Boesnage to solicit aid in this country, to enable them to resist the oppression of Louis XII. the town and parish contributed, by the king's permission, a pecuniary aid of 1030 merks, for which Boesnage's receipt is engrossed in the parish records. In 1645 Kirkcaldy sent so many men to contend with Montrose at Kilsyth, that his victory over them is said to have made 200 widows in the town alone. About the time of the revolution in 1688, the inhabitants contrived to apprehend the Earl of Perth, who was the lord chancellor under King James. They detained him five days under a guard of 300 men, and afterwards sent him, under a convoy of three boats and 200 men, to Alloa, where they delivered him over to the Earl of Mar. The most eminent native of Kirkcaldy was Dr Adam Smith, the author of the *Wealth of Nations*. The house in which he was born was taken down and rebuilt in 1835. Kirkcaldy unites with Dysart, Burntisland, and Kinghorn, in sending a member to parliament. In 1833 the constituency of these four burghs consisted of 502 voters, whereof there were enrolled in Kirkcaldy 314, in Dysart 105, in Burntisland 46, and in Kinghorn 37. Population in 1831, 5034.

KIRK, a Saxon term, signifying the same with church.

Kirk-*Sessions*, the name of a petty ecclesiastical judicatory in Scotland. Each parish, according to its extent, is divided into several districts, every one of which has its own elder and deacon to oversee it. A consistory of the ministers, elders, and deacons of a parish, forms a kirk-session; and these meet once a week, the minister being their moderator, but without a negative voice. It regulates matters relating to public worship, catechising, visitations, and the like. It judges in lesser matters of scandal, but greater, as adultery, are left to the presbytery; and in all cases an appeal lies from it to the presbytery. Kirk-sessions have likewise the care of the poor and poor's funds.

KIRCUDBRIGHT, a county in Scotland, situated between 54. 43. and 55. 19. north latitude, and 3. 33. and 4. 34. west longitude from Greenwich, is bounded on the north by the shires of Dumfries and Ayr, on the east and south by the Solway Frith and the Irish Sea, and on the west by the county of Wigtown. It derives its name from *Caer*, a fort, the Anglo-Saxons having erected a fort in honour of St Cuthbert, near the site of the present Kirkcudbright (originally *Caer Cuthbert*), the county town. It is in length from east to west about forty-eight miles, it varies in breadth from thirty to seventeen miles, and it contains 882½ square miles, or 564,480 English acres. This district is commonly called the *stewartry*, not the shire, of Kirkcudbright; and its judge, whose powers and duties are the same as those of a sheriff, is called a *steward*. The appellation of stewartry had its rise in the ancient tenure by which it was held, and the subsequent forfeiture of its lords; but the distinction between stewartry and sheriffdom is in this case purely nominal. Kirkcudbright is one of the two counties comprehended under the general name of Galloway, Wigtownshire on the west being the other.

About two thirds of the surface is mountainous. A range of mountains stretches along the whole northern boundary, in the form of a vast amphitheatre, embracing nearly half the county; on the boundary with Ayrshire they are not much inferior in height to any in the south of Scotland. There are also some considerable mountains on the southern extremity, such as Criffel, 1831 feet in height; Cairnsmore, 2597; and Cairnharrow, 1110. The high lands are for the most part covered with heath, except on a part of the northern boundary, where a narrow tract of green hills runs out between the counties of Ayr and Dumfries; and many of them are wet and mossy. In the middle of the district, the declivity is so gentle that the river Dee, at thirty miles from its mouth, is only 150 feet above the level of the sea; yet, even in the interior, there is no great extent of level ground, the greater part of the surface being occupied by rocky knolls, steep banks, and hills of a moderate elevation. On the coast, also, hills rise almost everywhere to the height of several hundred feet. The district is studded with a great number of lakes, of which there is one or more in almost every parish, though few of them are considerable. As there is not much full-grown wood, and the plantations are but partial, and for the most part not of many years' growth, the general appearance of the stewartry is that of a bleak, exposed country, on which labour has been but recently employed, and where its efforts must always be confined to a comparatively small field. Yet it contains many spots of great natural beauty, particularly on the coast, where the sea has in several places formed deep bays, surrounded with high grounds, some of which are fringed with coppice.

The soil of the lower grounds is, for the most part, of a hazel colour, sometimes inclining to red, and seems to be chiefly composed of argillaceous schistus in a state of decomposition. It is seldom of any great depth, and the rock, often rising above the surface, gives a rugged and sterile appearance to much even of the arable land. This soil is, however, in many instances possessed of great natural fertility, not soon injured by wet seasons, and affords plentiful crops and fine natural herbage. Clay is of no great extent, and found chiefly on the banks of the rivers. The smooth round hills accessible to the plough have, for the most part, a close subsoil, here called *till*, and do not, therefore, admit of being profitably cultivated but after an interval of several years pasturage. Tracts of moss, commonly from four to eight feet deep, extend over a tenth or twelfth part of the whole county.

Much of the mountainous district is composed of granite. According to the *Agricultural Survey*, there are three several districts of this rock, which occupy nearly a fourth of the surface. Strata of very dissimilar substances, to which Dr Hutton has given the general name of schistus, prevail in the lower parts. Some are of a hard, compact grain, of a blue or grayish-brown colour, for the most part breaking irregularly, but often in parallel plates, of which coarse slates have been made. With these are intermixed layers of a soft argillaceous stone, which readily yields to the weather, and is popularly known by the name of *slate band*. These rocks, which also occupy a large part of the district, are sometimes traversed by dykes of porphyry, and also by granite. In the neighbourhood of Dumfries the prevailing rock is sandstone. Limestone is found at Kirkbean, on the Nith, the only place in the county where it is wrought; and there are also some promising indications of coal on the estate of Arbigland, near Dumfries. In the parish of Colvend, on the Solway Frith, there is a quarry which affords millstones. Lead mines were wrought in Minnigaff, on the western boundary, for many years, but have been discontinued. Iron ore abounds, but, from the want of coal and wood, it is of little value. On the estate of Mr Murray of Broughton, near Gatehouse, copper has lately been discovered, and is now being wrought by an English company.

The rivers are, the Nith, which separates this county from Dumfriesshire for about nine miles on the north-east; the Urr, which flows south-east by the village of Dalbeattie, and is navigable five or six miles for small vessels; the Dee, the largest river, which enters Loch Ken, a lake almost in the centre of the county, about eight miles in length, and in some places a mile in breadth, and, giving its name to the river which issues from the lake, falls into the Solway Frith about five miles below the town of Kirkcudbright. It is navigable for two miles above this town for vessels of 200 tons. In spring-tides the water rises about thirty feet at Kirkcudbright, where there is a well-sheltered natural harbour, of easy access. For the last seven or eight miles of its course the banks of the Dee are planted. St Mary's Isle, near Kirkcudbright, is a highly ornamented spot; and the Little Ross, a beautiful island, is situated at its mouth. There are other small islands, as those of Fleet, Knockbrex, and Heston, scattered along the coast. The salmon fishery on this river was rented, some years ago, at L.900. The Fleet is remarkable for the picturesque scenery on its banks; but, as its stream is circuitous, and it often changes its course, a canal of about a mile in length has been cut, at the sole expense of Mr Murray of Broughton, by means of which the navigation to Gatehouse, a village about four miles from the sea, has been rendered easy. The Cree, a more considerable river, separates this county from Wigtonshire, and flows into the bay of Wigton, from whence it is navigable to the small harbour of Carty, a little below Newton-Stewart. The stewartry is everywhere supplied with pure springs and rivulets. Chalybeate springs are also numerous, one of which, Lochenbreck, in the parish of Balmaghie, seven miles from Gatehouse, is said not to be inferior in medicinal virtues to any in the kingdom.

The landed property is not divided into large estates. Out of 1043, their number in 1808, as given in the *Agricultural Survey*, 972 are stated to have been below L.500 a year. The valued rent, which was taken in 1642, is L.114,637. 2s. Scots; the real rent, in 1808, was estimated at L.167,125 sterling, and in 1831 at L.213,308. Many of the smaller proprietors cultivate their own estates. According to the work just referred to, almost half the county is held under deeds of entail, many of which have been executed very lately. "The condition of the peasantry, at a period not very remote, seems to have been much depressed, and the state of husbandry rude and barbarous in the extreme." (Smith's *Survey*.) Referring to the year 1720, John Maxwell of Munshes observes that "the tenants in general lived very meanly, on kail, groats, milk, graddon ground in querns turned by the hand, and the grain dried in a pot, together with a crock ewe now and then about Martinmas. They were clothed very plainly, and their habitations were most uncomfortable. Their general wear was of cloth made of waulked plaiding, black and white wool mixed, very coarse, and the cloth rarely dyed. Their hose were made of white plaiding cloth, sewed together, with single-soled shoes, and a black or blue bonnet, none having hats but the lairds.......In 1725 potatoes were first introduced into this stewartry by William Hyland, from Ireland, who carried them on horses' backs to Edinburgh, where he sold them by pounds and ounces. During these times, when potatoes were not generally used in this country, there was for the most part a great want of food, bordering on famine; for, in the stewartry of Kirkcudbright, there was not as much victual produced as was necessary for supplying the inhabitants. The produce of the country in general was gray corn; and you might have travelled from Dumfries to Kirkcudbright, which is twenty-seven miles, without seeing any other grain, except in a gentleman's croft, which in general produced bear or big for one third part, another third in white oats, and the remaining third in gray oats. At that period there was no wheat raised in the country; what was used was brought from Teviot, and it was believed that the soil would not produce wheat. In the year 1735 there was no mill for grinding that sort of grain; and the first flour mill that was constructed within these bounds was built at Clouden, in the parish of Irongray, some years after that date." (Murray's *Literary History of Galloway*, 2d edition, 1832, pp. 337–9.) Yet it was in this county that the improvements of modern husbandry were adopted, at a time when they were entirely unknown in the greater part of the kingdom. As early as the year 1750, Mr Craik of Arbigland practised the drilling and horse-hoeing of the celebrated Tull, which he ever afterwards continued to follow in the culture of beans and turnips. He enclosed and drained his estate, cleaned his fields by fallowing, applied calcareous manures, introduced sown grasses into his course of crops, and worked his plough with two horses. A few of the other proprietors followed in his steps, but their efforts were not seconded by the tenantry at large. It is only since the end of last century that modern husbandry has made any considerable progress, but it is now quite general. The chief crops are oats and barley, with wheat on the better soils.

A great impetus has lately been communicated to agriculture in this county, by the regular and cheap communication with Liverpool by means of steam-navigation. The farmers have thus a ready outlet for their disposable produce, corn, cattle, and sheep, and receive cash payments. Instead of being, as formerly, far from a market, and forced in consequence to sell to corn-dealers, a class of men with whom bankruptcy was any thing but uncommon, the farmers are now, as it were, placed in the very vicinity of the best market, and are freed from all risk of non-payment. By these favourable circumstances, a spirit of improvement and enterprise has been roused, which promises, ere long, to change the face and character of the county. Nothing, indeed, has ever effected so important a change in the circumstances of this county, as the introduction of steam-navigation. The first steam-boat seen on its shores was in 1830; and there are now three that ply regularly between it and the English coast, particularly Whitehaven and Liverpool. Their decks are covered with sheep and black cattle, whilst their holds are filled with corn. Nor is this all. These vessels have opened up channels of industry before quite unknown. Poultry, eggs, and butter, by being sent to the ready market of England, form a new and pretty productive source of income. Salmon, instead of being sent as formerly round to England by the expensive mail-carriage, is now transmitted thither by steam more directly, and at much less expense; whilst commodities required from England are obtained under the most favourable circumstances.

Unlike other hilly tracts in Scotland, the land is almost universally enclosed, chiefly with stone walls, called *Galloway Dykes*. These dykes are built close, or double as it is called, for part of their height, and afterwards single, the stones in the latter part being laid in such a manner as to allow the passage of the light through the wall. But it is now becoming a common practice to build the whole of the wall double, and, after laying a course of stones that project a little beyond its breadth on both sides, it is completed by a coping of stones laid on edge, and closely pinned.

This county is chiefly celebrated for its cattle, which form by far the most important part of its agricultural produce. They are known in every part of Britain by the name of *Galloway cattle.* (See AGRICULTURE.) Sheep are confined to the mountainous districts, where they are kept in great numbers. They are of the heath or black-faced variety, with coarse wool, and yield a very small return for the extent of their pastures, which, however, are in general of the very worst description in the south of Scotland, some large tracts being rented so low as 6d. an acre, or even lower. It is now becoming the practice to combine the rearing and fattening of sheep with the culture of arable land, by which the light soils of the other border counties have been rendered so productive. A small, hardy, and active race of horses, called *Galloways*, was formerly reared here and in Wigtonshire, the other division of Galloway; but a larger breed being required for the labours of modern husbandry, especially since two-horse ploughs have become general, the old race is very rarely to be found in a pure state. The name, however, is frequently applied to horses below full size, wherever they may have been reared.

The first road act for the stewartry of Kirkcudbright was obtained in 1779. At that period there was scarcely any thing that deserved the name of a road, except the military road from Dumfries to Portpatrick, which had been made about fifteen years before; but at present very few districts are better provided in this respect. The first good roads were made on the estate of the Earl of Selkirk, under the direction of his son Basil William Lord Daer, to whom this county owes many other improvements. In 1796, by another act of parliament, the assessments were allowed to be increased, and tolls erected; and soon afterwards a new road was made from Dumfries to Castle-Douglas, a distance of eighteen miles, through a hilly, broken country, with so much attention to preserve the level, that it has seldom a rise of more than one foot in forty, and much of it is nearly a perfect level. All the principal roads made since have been done with equal judgment. The turnpike roads, in 1834, extended to 216 miles; and the annual income obtained from tolls amounted to L.2557. The district is also well accommodated with bridges, of which the most considerable is one over the Dee at Tongland, about two miles above Kirkcudbright, which has an arch of 110 feet span. It is built of sandstone, brought partly from Annan in Dumfriesshire, and partly from the Isle of Arran. It was finished in 1808, and cost upwards of L.7000.

Kirkcudbright, the county town, which was erected into a royal burgh in 1455, contained, in 1831, a population of 3511. It is pleasantly situated on the Dee, and is noted for the information and urbanity of its inhabitants. Societies have been formed here for a purpose rather unusual, namely, the building of houses, not for sale, but for the use of the members who compose them. Every member makes a small monthly payment into a general fund, which is employed in erecting the houses, and these, as they are finished, are assigned to the members by lot, those to whom they fall paying five per cent. on the money which their houses have cost, in addition to their monthly payments; and this arrangement continues till all the members are supplied, and the societies dissolved. New Galloway, which was erected into a royal burgh in 1633, is situated at the head of Loch Ken, and contains only about 400 inhabitants. The principal villages are Creetown, at the mouth of the river Cree, on the bay of Wigtown; Gatehouse, twelve miles east from the former, on the river Fleet; and Castle-Douglas, formerly called Carlinwark, an inland place, about nine miles north-east of Kirkcudbright. The Galloway Bank, now discontinued, was established at Castle-Douglas in June 1806. A branch of the Bank of Scotland had been introduced into the burgh of Kirkcudbright about twenty years previously. These three villages seem to be in a thriving state; the houses are for the most part of two stories, and, in other respects, they are superior to villages of the same extent in many other parts of Scotland. The others are Dalbeattie on the river Urr; Keltonhill, noted for its great cattle fairs in June and November; and Maxwellton, on the Nith, which, though in this county, belongs by its situation to the town of Dumfries, from which it is separated only by the bridge over that river. By the reform act, indeed, it is included within the parliamentary boundaries of that town.

There are no regular assessments for the poor in the country parishes, but the ordinary kirk-session funds have been much augmented in some parishes by charitable donations. In some instances voluntary assessments upon the part of the heritors take place, particularly in unfavourable seasons.

The inhabitants of the stewartry have few traits of character peculiar to themselves. Living remote from the capital, or any large town, they are a simple, unsophisticated people, feudal and superstitious in their sentiments. A belief in witchcraft, and in the more popular superstitions, still obtains. They think no character superior to the minister or the laird. These peculiarities, however, are beginning to give way. Education has attained a most respectable footing; and the collision of sentiment which the people experience by the intercourse now opened up by the facilities of communication with strangers has had a most salutary and liberalizing influence. They are an enterprising people. They send, on an average of the last ten years, about forty young men to the university yearly; and the number of those who annually cross over to England to push their fortune, or emigrate either to our own colonies or to foreign states, is extremely great. Of these, not a few, after experiencing success in life, return to their native country with a respectable competency; and thus, by their example, stimulate others to follow their steps. Of the extent to which emigration from this county is carried, a correct estimate may be formed from the fact that, though the number of males born is about five per cent. above that of females, the latter in the stewartry exceed the former by 2642. A great number of Irish, of the lowest grade, are settled here.

Education, as mentioned above, is in a respectable state. Some of the schools are excellent; few of them are bad; and when a vacancy now takes place, the utmost pains are taken to get the best teacher to fill it. Several sums have been bequeathed by individuals for the support of schools, particularly in the parishes of Balmaclellan, Dalry, and Borgue. In addition to the parish schools, there are many voluntary seminaries, which are in a highly respectable and efficient state.

It has already been mentioned that the people are distinguished for their religious character. The reformation began here at a peculiarly early date, namely, the begining of the fifteenth century (*Literary History of Galloway*, p. 61), and some of the most eminent reformers and covenanters were connected with this county. The persecution in the times of Charles I. and his son Charles II. raged most hotly here. The graves of martyrs are to be found, not only in almost every churchyard, but even in many of the wildest moors. Presbyterianism still continues predominant. In addition to the twenty-eight parish churches, there are one chapel of Ease at Maxwellton; one church of the Cameronian persuasion at Urr; and six of the United Associate Synod at Urr, Castle-Douglas, Dalry, Kirkcudbright, Creetown, and House of the Hill. There is no Episcopalian chapel, but there are two belonging to the Roman Catholics, one at New Abbey and another at Dalbeattie; and one Independent meeting-house at Gatehouse.

The stewartry could boast of a greater number of monasteries than any other county in Scotland. These were, Dundrennan, St Mary's Isle, and Tongland, founded in the twelfth century, by Fergus, lord of Galloway; Lincluden, by his son Uchtred; and Sweetheart, or New Abbey, founded in the thirteenth century, by Dervorgille, daughter of Alan, last lord of Galloway, and mother of John Baliol, the competitor for the throne. Of the three first of these buildings, the remains are comparatively entire; of the other two, all vestiges have disappeared.

The bishopric of Galloway, both in Catholic and in Protestant times, comprehended the stewartry and Wigtonshire. It formed the most ancient see in Scotland; and in dignity was inferior only to the archbishopric of St Andrews and Glasgow, till in 1633, when Edinburgh was erected into a bishopric, and obtained the preference over Galloway. The bishops of Galloway were *ex officio* deans of the chapel royal of Stirling.

Some very eminent men have been connected with the stewartry as monks or bishops, such as David Panther of St Mary's Isle, afterwards bishop of Ross; William Melville of Tongland, afterwards a lord of session, under the title of Lord Tongland; Gilbert Brown of Sweetheart, well known as the author of a small but learned work against the famous John Welsh, minister of Kirkcudbright; and the following bishops of Galloway, Alexander Gordon (known in history as archbishop of Athens); William Cowper, an eminent and learned theological writer; and Thomas Sydserff. Nor in more modern times has this county been less distinguished for eminent literary characters. Robert Maxwell, author of *The Practical Husbandman*, and several other excellent works on agriculture; Thomas Gordon, the translator of *Tacitus*, and author of *The Independent Whig*, and other works; Robert Heron, author of a *History of Scotland* in six volumes, and numerous other publications; Dr Alexander Murray, the celebrated linguist; Dr Thomas Brown; Thomas earl of Selkirk, author of an able work on emigration; not to mention many others, such as John Welsh and Samuel Rutherford, who were connected with this district by office and residence. In 1835 a monument to the memory of the late Dr Alexander Murray was erected near the place of his birth, in the parish of Minnigaff. The funds (L.450) were raised by subscription; the height of the pillar is eighty feet.

The occupations of the people, according to the population returns in 1831, were as follows:

Occupiers of land employing labourers	871
Occupiers of land not employing labourers	490
Labourers employed in agriculture	2648
Employed in manufactures	529
Employed in retail trade and handicraft	2299
Capitalists, bankers, &c	440
Labourers not agricultural	1076
Other males twenty years of age	805
Male servants	108
Female servants	2378

The county, as is evident from this table, is not remarkable for manufactures; but it contains a larger number of men employed as weavers than home consumption would require. They weave to a limited extent for the Glasgow, Paisley, and Kilmarnock markets. The number of weavers was altogether above 500. But since 1831 the cotton mills at Gatehouse have been revived under the best management, and in this way perhaps 200 more are added to the manufacturing class. There are also stocking-makers, cloggers, and nailers. The chief exports of the county are the produce of the soil; grain, black cattle, sheep, and wool; the chief imports are coals, lime, groceries, timber, iron, and slate.

It has already been stated, that the mountainous districts of the stewartry are composed of granite. A granite quarry was opened in 1830, on the estate of Cassencarrie, in the parish of Kirkmabreck, by the Liverpool Dock Company. This is at present the most important work of the kind carried on in Scotland. About 300 workmen are daily employed in it; machinery of a kind previously unknown in Galloway has been introduced; a railway has been constructed connecting the quarry with Wigton Bay, a distance of about half a mile; and a new harbour has been built at the expense of the company, the vessels belonging to which transport the stone from thence to Liverpool. Besides defraying surface damage for the line of the railway, the company pay to the landlord a sum proportional to the produce of the quarry; and thus a piece of land, which was previously covered with rock and heath, and literally worth nothing, certainly not twenty shillings, now realizes an annual rent of about L.400.

The following table contains the abstract of the population at different times.

YEARS.	HOUSES.			OCCUPATIONS.			PERSONS.		
	Inhabited.	By how many Families occupied.	Uninhabited.	Families chiefly employed in Agriculture.	Families chiefly employed in Trade, Manufactures, or Handicraft.	All other Families not comprised in the two preceding classes.	Males.	Females.	Total of Persons.
1811	6223	7380	196	2662	1885	2833	15,788	17,896	33,684
1821	6441	7912	190	3047	2238	2627	18,506	20,397	38,903
1831	6604	8283	146	2826	2293	3164	18,969	21,621	40,590

The stewartry sends one member to parliament, the constituency in 1835 amounting to 1166. In the election for the burghs, Kirkcudbright (which contains 111 electors) joins with Dumfries, Sanquhar, Annan, and Lochmaben; and New Galloway (which contains sixteen electors) with Wigton, Stranraer, and Whithorn. It is divided into twenty-eight parishes, of which sixteen belong to the presbytery of Kirkcudbright, and two to that of Wigton, both in the synod of Galloway, and ten to the presbytery and synod of Dumfries.

See *Bauties of Scotland;* Murray's *Literary History of Galloway*, 2d edition, 1832; Smith's *Agricultural Survey*, 1810; *The General Report of Scotland;* Playfair's *Account of Scotland;* and Chalmers's *Caledonia*. But the greater part of this article is derived from personal knowledge and private documents.

KIRKHAM, a town of the county of Lancaster, in the hundred of Amounderness, 226 miles from London. It is near the river Ribble, and has a way across the sands and that river, which requires a guide, to Tarleton, a distance of three miles. There is a market on Thursday; and some sail-cloth manufactories are carried on. The inhabitants amounted in 1801 to 1561, in 1811 to 2214, in 1821 to 2735, and in 1831 to 2469.

KIRKKILLISSA, or KIRKLEESON, a city of Turkey in Europe, the capital of a circle of the same name, in the province of Rumili, about eighty miles from Constantinople, on the road to Silistria. It is surrounded with old walls, is defended by a citadel, and contains a bazar, several mosques, churches, and baths, and about 1600 inhabitants, amongst whom are many Jews, and some Greeks. Though the country around it is stony, it produces abundance of grapes, melons, and other fruits; and much wine is made. Long. 16. 55. E. Lat. 41. 50. N.

KIRMAN, or KERMAN, a province of Persia, is bounded on the east by a part of Seistan and Beloochistan, west by the province of Fars, south by Laristan, Mukran, and the Persian Gulf, and north by Irak and Khorassan. It has been in all ages partitioned into the habitable and desert regions; the former extending, in extreme length, from Regan, in Nurmansheer, to Robat, on the boundary of Fars, about 305 miles, and in breadth, from the southern limit of Irak to the town of Gombaroon or Bunder Abass, on the shore of the Persian Gulf, about 280 miles in a direct line.

Even the soil of this habitable tract is in many places unprolific, and the face of the country barren and waste. There is not a river in the province, the few streams that occur being merely mountain torrents swelled by the rains, and dry during the remainder of the year; and were it not for a few springs in the mountainous districts, and the karezes or under-ground aqueducts (a singular contrivance, common in Persia, by which water is conducted, by means of pits from thirty to ninety feet deep, and about 100 paces apart, and connected by a common trench, sometimes a distance of thirty or forty miles), the inhabitants could not possibly exist. In this manner water is procured with extraordinary pains and attention, and withal not more than sufficient to cultivate a very trifling portion of the soil. The only exception to this description is the district of Nurmansheer; but, even here, the abundant supplies of water, once so common, have much decreased within the last twenty years; and Lieutenant Pottinger, in travelling through this country, concluded, from the vast tracts of desolate plains which are encountered in travelling across the country from the east towards Kirman, that the desert was fast encroaching on the regions of cultivation.

The country is, generally speaking, mountainous. The principal range of mountains is that which divides Nurmansheer from Laristan, and thence, running in a south-westerly direction, approaches within four days of Gombaroon. Here, running along the coast to the west and north-west, it joins the mountains of Fars, in latitude 29. 40. N. and longitude 54. E. In its course it throws out numerous ramifications, both to the northward and southward. So entirely do these hills intersect the country, that the plains which they separate seldom exceed ten or twelve miles in breadth, though often of an indefinite length. The climate of the province varies of course with the inequality of the ground. Snow lies to a great depth on the mountains in winter, and, from their loftiness, it does not melt for the greater part of the year; so that the people in the plains are frequently seen panting from extreme heat, whilst it is freezing in the adjacent mountains. The cold mountain air also is far from salubrious, as it brings along with it agues, fevers, and other diseases; so that the natives prefer the most sultry weather.

To the southward of the great chain of mountains, and between their base and the sea, lies the Gurmseer, or hot country, which is a narrow strip, varying from thirty to ten leagues in breadth, and extending all along the sea-coast of Persia, from Meenab, the capital of Laristan, to the mouth of the Shatool-Arab or Bussorah River. The portion of this tract that lies within the limits of Kirman is almost solely composed of saline sand; it produces nothing but dates of a very inferior quality, and the climate is peculiarly unhealthy.

The desert region of Kirman extends 270 miles in length, from the northern boundary of Nurmansheer, in latitude 29. 30. north, to the mountains of Khorassan, in latitude 34. north; and in breadth 200 miles, from the city of Yezd, in longitude 55. 40. east, to a range of mountains separating it from Seistan, in 60° east. The whole of this tract is a salt desert, and so decidedly barren, that it does not even produce grass, or any other vegetation, for eighty or ninety miles at a stretch; nor is there a drop of water. The Afghan army, on its march to invade Persia in 1719, lost one third of its numbers in this desert. There is a path from Kirman to Herat in Khorassan, by which couriers can travel in eighteen days; but the risk is so great that a high sum is always demanded for such a journey.

This province is famous for very fine wool, produced by great flocks of sheep and goats, which are fed on the mountains, cold in winter, and hot and arid in summer. Not only is the wool of the sheep of very fine quality, but the goats produce a down that grows in winter at the roots of the hair, in the same manner as that of the Thibet and shawl goats, and nearly as fine. This is spun into various fabrics, which almost vie with the celebrated shawls of Cashmere in fineness and beauty of manufacture. From the wool of the sheep are made shawls, numuds, and felts, which are celebrated all over Asia. The wool is prepared in a peculiar manner, being immersed in a wash, the ingredients of which are known only to the makers. The Kirmanees are also famed for the manufacture of matchlocks. These they send to Khorassan, Cabul, Balkh, Buckharia, and the northern provinces; and in return receive assafœtida, gums, rhubarb, madder, and other drugs; Buckharia skins, furs, silk, steel, copper, and tin (the last three articles are for home consumption; they export the remainder to India, Sinde, Arabia, and the Red Sea); pistachio nuts, rose leaves and buds for making conserve, gums, cotton, carpets, and buttons. They import from India tin, lead, iron, copper, steel, pepper, and all other spices; chintz both European and Indian, indigo, muslin, tea, satin, gold, flowered silks, gold-cloth, cocoa-nuts, china and glass-ware, broad cloth, &c. From Sinde they receive white cloth and coloured stuffs for turbans; and from Arabia and the Red Sea coffee, gold-dust, ivory, musk, frankincense, stones, &c.

KIRMAN, or *Kerman*, called also sometimes Sirjian, a large city, and capital of the above province, situated on the western side of a capacious plain, so close to the mountains, that two of them, on which there are ancient forts, completely command it. It was in early times one of the most flourishing cities in Persia, and was inferior to none in size except the capital, Ispahan. It became, by its situation in the direct road from Khorassan, Balkh, Buckharia, the countries beyond the Oxus, and all the northern part of the Persian empire, to the sea-port of Bunder-Abass, a great emporium of eastern commerce, and the centre of wealth, learning, and magnificence. The date of its foundation is not ascertained, but Lieutenant Pottinger states, on the authority of a manuscript history of the conquest in the 90th year of the hejira, or about the 700th year of the Christian era, that Kirman was then a very extensive city, full of riches, and celebrated for the excellence of the shawls and arms made in it; and he imagines that its foundation is coeval with the renowned city of Ormuz. No city has been subject to greater reverses of fortune, or oftener the scene of severe, destructive wars, both foreign and domestic, than Kirman. It has been successively taken and plundered by the caliphs, by Ghengis Khan, Tamerlane, the Afghans, and Nadir Shah: in addition to all that, it has suffered from civil broils, in the course of which it has often been taken by storm. The last event of this kind took place in the year 1794, when it was betrayed into the hands of Agha Mahommed Khan, uncle of the present king, and founder of the Kajjar dynasty, who had besieged it in vain for several months. Under this eastern barbarian the city was given up for three months to incessant ravages by a licentious soldiery. All its fortifications and elegant structures, which were raised by the Afghans, were razed to the ground; and the cruel conqueror, after sacrificing to his revenge every person of whom he had the slightest suspicion, carried 30,000 of the inhabitants into slavery, or exiled them to the distant provinces of Mazunderan and Azerbijan. After this dreadful calamity, the city lay desolate for some years after the accession of the present king, who directed the fortifications to be rebuilt on a reduced scale. They are still, however, large, and consist of a high mud wall, with nineteen bastions, and a dry ditch twenty yards wide and ten deep. The works are entirely encompassed by ruins. There are four gates, and the ark or the citadel, in which the governor's palace is built, and which is on the southern face of the fort, is defended by similar works. The bazar is well supplied with articles of every description, and from every nation: one part of it is covered in with very elegant domes, built of a beautiful blue stone, dug from quarries in the adjacent mountains. There are eight or nine caravanserais within the walls, besides many inferior ones outside. Kirman contains 30,000 inhabitants, consisting of Armenians, Hindus, or Jews, resident in the place, and of a small proportion of Guebres or Parsees. The trade of the town, though considerable, has never revived to its former extent; and it is not likely that it will again do so, as the great resort of merchants is now to the sea-port town of Bushire, farther up the Gulf of Persia, to the prejudice of Bunder-Abass, and of course of Kirman, of which Bunder-Abass is the port. Its manufactures of shawls, matchlocks, and numuds or felts, are celebrated all over Asia, and are said to afford employment to upwards of one third of the inhabitants, whether male or female. The former are made from the famous wool already described, and rival those of Cashmere in delicacy of fabric and texture, though they are not equal in downy softness and warmth. The revenues of the city, which in 1810 amounted to L.25,000 per annum, and are said to be rapidly increasing, are employed by the prince in maintaining his court, and a body of troops for the protection of the city and neighbourhood from the incursions of the wild predatory tribes of the mountains. These duties arise from a heavy tax on shawls and matchlocks. Camels, horses, &c. which enter any caravanserai in the city, are charged each one rupee. Long. 56. 6. E. Lat. 29. 56. N.

KIRKWALL, the chief town in the Orkney Islands, is situated in long. 3. 23. 6. W. and in lat. 58. 59. 31. N. It consists principally of one crooked, narrow street, about a mile in length. The number of inhabitants in the town and adjoining parish was by the last census 3721. There are four places of worship in the parish, the established church, the United Secession meeting-house, a congregation in connection with the Associate Synod of Original Seceders, and a congregation of Independents. There are ten schools in Kirkwall, attended by 422 scholars; of these, seventy-one are learning Latin, and twelve mathematics. The entire population between the ages of six and twenty are able to read, and in the parish there are only ten or twelve persons unable to read. There are from ninety to a hundred persons on the poor's roll, who are relieved by the contributions made at the church door, which average about L.50 a year. The trade of Kirkwall, in relation to the population, is considerable. For the year ending 31st December 1834, the amount of tonnage of vessels cleared outwards, coastwise and foreign, was 8248; and, for the same period, the amount of tonnage inwards was 10,304. There were in December 1835 seventy-eight registered vessels belonging to the port, with a tonnage of 4238, and navigated by 326 seamen. The custom-house duties on goods imported from December 1833 to December 1834 amounted to L.1148; there were no export duties. The principal imports are wood, hemp, iron, tar, groceries, coals, cloths; and the exports consist chiefly of kelp, fish, corn, cattle, and wool. It has been found impossible to give any thing at all approaching to the correct value of the articles imported and exported, as there is no record of these kept. The principal buildings in Kirkwall are the cathedral of St Magnus, the choir of which is still occupied as the parish church; the earl's palace; and that which formerly belonged to the bishops of Orkney. St Magnus's Church was founded by Ronald, count of Orkney, about the middle of the twelfth century. It is in the form of a cross; its length is 225 feet, and its breadth fifty-six; the roof is seventy-one feet from the floor, and the spire rises about seventy feet higher. The roof is supported in all by thirty-two pillars, of which the four that support the central tower are twenty-four feet in circumference. The earl's palace was commenced about 230 years ago, by Patrick earl of Orkney, and, though now in ruins, its remains show that it must have been a strong and magnificent edifice. The large hall is sixty feet long by twenty broad, and is lighted by four spacious windows. The bishop's palace is almost an entire ruin, the only part that remains in any thing like preservation being a round tower erected by Bishop Reid, a statue of whom still occupies a niche fronting the cathedral. In this palace Haco king of Norway died on his return to Orkney, after the unsuccessful battle of Largs in 1263. The remains of an old building, the castle of Kirkwall, erected in the fourteenth century, by Henry St Clair, the first earl of that name, are still to be seen; and the antiquary will be gratified to learn that the house in which James V. passed the night during his visit to Orkney in 1540 is yet in existence. Kirkwall is the seat of the sheriff, commissary, and justice of peace courts. It is a royal burgh, and, along with Wick, Dingwall, Tain, Cromarty, and Dornoch, returns a member to parliament. There are fifty-eight voters in the town.

KIRSTENSIUS, Peter, professor of physic at Upsal, and physician extraordinary to the queen of Sweden, was born at Breslau in 1577. He studied Greek, Latin, Hebrew, Syriac, natural philosophy, anatomy, botany, and other sciences. Being told that a man could not distinguish himself in physic unless he understood Avicenna, he applied himself to the study of Arabic; and qualified himself not only to read Avicenna, but also Mesue, Rhasis, Abenzoar, Abukasis, and Averroes. He visited Spain, Italy, England, and did not return home from his travels till after seven years. He was chosen by the magistrates of Breslau to take the direction of their college and of their schools. A fit of sickness having obliged him to resign that difficult employment, with which he was also much disgusted, he applied himself chiefly to the practice of physic, and went with his family into Prussia. Here he obtained the friendship and esteem of the chancellor Oxenstiern, whom he accompanied into Sweden, where he was made professor of physic in the university of Upsal, and physician to the queen. He died in 1640. It is said in his epitaph, that he understood twenty-six languages. He wrote many works, amongst which are, 1. Liber secundus Canonis Avicennæ, typis Arabicis, ex manuscriptis editus, et ad verbum in Latinum translatus, in folio; 2. De vero usu et abusu Medicinæ; 3. Grammatica Arabica, folio; 4. Vitæ quatuor Evangelistarum, ex antiquissimo codice manuscripto Arabico erutæ, in folio; 5. Notæ in Evangelium S. Matthæi, ex collatione textuum Arabicorum, Syriacorum, Egyptiacorum, Græcorum, et Latinorum, in folio. He ought not to be confounded with *George Kerstenius*, another learned physician and naturalist, who was born at Stettin, died in the year 1660, and is also the author of several works.

KIRTHIPOOR, a town of Hindustan, in the province of Nepaul, and district of Patan. It was formerly the capital of an independent principality, and was at one time said to contain 6000 houses or families within its jurisdiction; but is at present of little consideration. This place was besieged by Purthi Narrain, the Ghoorkali rajah, and taken, in 1768, after a long and obstinate resistance, at which he was so enraged that he ordered the noses and lips of the survivors to be cut off, without exception of age or sex; and, twenty-three years afterwards, the British ambassador at Nepaul found many persons who had outlived this mutilation. It is three miles from Patan. Long. 85. 37. E. Lat. 27. 30. N.

KIRTLE, a term used for a short jacket, as "the flowery-*kirtled* Naiads;" also for a quantity of flax, about a hundredweight.

KIRWAN, Richard, a celebrated chemist, born in the county of Galway, in Ireland. He was originally destined to the study of the law, and, having been called to the bar, followed the profession of advocate, until some circumstances obliged him to quit it; whereupon he applied himself to the study of the natural sciences, to which his taste had always inclined him. Having established himself in London or its neighbourhood, about the year 1779, he read, at the sittings of the Royal Society of which he had become a member, several memoirs, for which, in 1781, the Copley medal was adjudged to him. Having returned to his native country about the year 1789, he was some time afterwards elected president of the Royal Irish Academy, and published several works, not only on chemistry, geology, and mineralogy, but also on metaphysics and logic. He was likewise president of the Dublin Society, and a member of the principal literary and scientific associations in Europe. He died on the 22d of June 1812, at a very advanced age. Kirwan was regarded as the Nestor of the British chemists, and almost all the natural sciences have been more or less indebted to his long labours. His works are, 1. Experiments and Observations on the Specific Gravities and Attractive Powers of various Saline Substances, published in the Philosophical Transactions; 2. Elements of Mineralogy, 1784, in two vols. 8vo, translated into German by Crell; 3. An Essay on Phlogiston and the Constitution of Acids, 1787; 4. An Estimate of the Temperature of Different Latitudes, 1787, in 8vo; 5. A Treatise on the Analysis of Mineral Waters, 8vo; 6. Logic, 1789, in two vols. 8vo; to which may be added, various communications to the learned societies of which he was a member. At Dublin he formed an association for the express purpose of cultivating mineralogy; and, as a geologist, he distinguished himself by advocating what has since been called the Neptunian theory of the earth, in opposition to that of Dr Hutton. (A.)

Kirwan, *Walter Blake*, a celebrated Irish preacher, was born in the county of Galway about the year 1754. He was descended of an ancient family of the Roman Catholic persuasion, and, in early youth, went to the college of the English Jesuits at St Omer, where he received the rudiments of his education. At the age of seventeen, he embarked for the Danish island of St Croix, in the West Indies, where a relation of his father had large possessions; but, after a residence of six years, during which he suffered severely from the baneful influence of the climate, he returned to Europe. He then entered the university of Louvain, where he took priest's orders, and was soon afterwards promoted to the chair of natural and moral philosophy. In 1778, he was appointed chaplain to the Neapolitan ambassador at the British court; and having obtained some reputation as a preacher, he published several sermons, which, however, do not appear to have attracted any notice. In 1787, he resolved to conform to the established religion, from "a conviction that he would thus obtain more extensive opportunities of doing good;" and was introduced by Dr Hastings, archdeacon of Dublin, to the congregation of St Peter's church, where he preached on the 24th of June. His audience were impatient to hear him relate the causes of his conversion, but they were disappointed; for, neither at this nor at any other time, did he ever breathe a syllable of contempt or reproach against any religious persuasion whatsoever. For some time after he had conformed to the established religion, he preached every Sunday in St Peter's church; but his reputation as a pulpit orator increased so rapidly that, before the expiration of a year, he was exclusively employed to preach charity sermons, a duty in the discharge of which his success had been unprecedented. In 1788, he was preferred to the prebend of Howth, and in the following year to the parish of St Nicholas Without, the joint incomes of which amounted to about L.400 a year; but he resigned the prebend on being presented, in 1800, to the deanry of Killala. His popularity as a preacher appears to have been extraordinary. Whenever he appeared in the pulpit, multitudes crowded to hear him. He was presented with addresses and pieces of plate from several parishes, and with the freedom of different corporations; his portrait was painted and engraved by the most eminent artists; and the collections made, when he preached, exceeded any thing that had ever been known. Even at periods of public distress, his irresistible powers of persuasion produced, by a single sermon, contributions exceeding a thousand or twelve hundred pounds; and his auditors, not content with emptying their purses into the plate, sometimes threw in jewels or watches, as earnests of future benefactions. But the fire which burned in his bosom at length consumed him, and he died on the 27th of October 1805, exhausted by the fatigues of his vocation, leaving a widow with two sons and two daughters, to whom the king granted a pension of L.300 a year, with reversion to the daughters. In 1814, a volume of his sermons was printed for the benefit of his sons, who were not included in this provision; but from these it would be difficult to discover the cause of his unexampled popularity, since, in point of literary merit, they bear no sort of proportion to the effects which, when delivered by him, they appear to have produced. The master-charm no doubt consisted in the manner, of which it is impossible for us to form any opinion. One thing is certain, however, that, in recommending charity, he was successful beyond all precedent, and that his private character corresponded, in all respects, with the humane and benevolent sentiments expressed in his public discourses. (A.)

KIRWAL, a town of Hindustan, belonging to the Mahrattas, in the province of Malwah, forty-two miles north-west from Bilsah. Long. 78. 13. E. Lat. 24. 2. N.

KISCHENAU, a town of the Russian province of Bessarabia, the capital of a circle of the same name, and the see of a bishop of Bessarabia and Moldavia. It has an ecclesiastical seminary of the Greek church, and about 3500 inhabitants, among whom are many Jews. Long. 29. 2. 55. E. Lat. 46. 59. 30. N.

KISHENAGUR, a town of Hindustan, in the province of Ajmeer, thirteen miles south-east from the city of Ajmeer. It is the capital of a small but independent principality, out of the revenues of which the rajah's descendants, amounting to 5000, are maintained. His government is completely patriarchal. The rajah is of the Rhatore tribe of Rajpoots. Long. 75. 1. E. Lat. 26. 32. N.

Kishenagur, a town and district of Bengal. The town is situated on the south-eastern side of the Jellinghy River. It is the residence of the rajah, and also of the judge-collector of the district of Nuddeah. It is noted for a manufacture of fine cotton cloths. Long. 88. 95. E. Lat. 23. 26. N.

KISHENGUNGA, a river of Hindustan, which has its source in the mountains to the north of the Packoli district, and, after a short course, joins the Jhylum River on the north-west frontier of the province of Lahore.

KISHLAK, a town of Persia, on the road from Shiraz to Ispahan, 146 miles west of Shiraz.

KISHM, Kishmee, or Jezira Derawz (Long Island). This is the largest island in the Persian Gulf, which extends sixty miles along the Persian shore, and is in no place more than twelve miles in breadth. The channel by which it is separated from the continent, which is from three to eight miles wide at the northern point of the island, is navigable for the largest vessels. This island has a most desolate and unpromising aspect; from whatever quarter it is seen, it presents nothing but light-gray rocks of shells or calcareous stone or brown sand, entirely devoid of verdure. The inhabitants, who amount to about 10,000, including the population of Kishmee, the capital, live chiefly by fishing and agriculture; and there are a few productive spots on the island, which yield a small supply of dates, as well as of wheat and barley. They also breed cattle and sheep, and the latter are said to thrive well. But this island, though now barren and deserted, is said at one time to have presented a very different appearance. It contained, we are informed, 360 well-inhabited villages, with date and fruit tree gardens; and from Ormuz, when it was in the height of its glory, were sent supplies of fruit, vegetables, and many descriptions of provisions. Since that period it has been the scene of great disturbance and rapine; pirates having of late years made descents upon it, plundering and destroying every thing within their reach, and wantonly cutting down the date and fruit trees, so that it can hardly supply the few remaining families with the food which they require. The fear of these descents drove the greater part of the inhabitants into the town of Kishmee, which is walled, and prepared for defence, and contains 8000 inhabitants, though Fraser, by whom it was visited in 1821, considers the number as rather exaggerated. The harbour or roadstead is not very safe, being open on the north-east to the deep channel that lies between it and Gomberoon; so that during the prevalence of the north-east winds, which blow violently from November to February, boats cannot land for many days together, on account of the surf. For eight months of the year, however, the roadstead may be considered as safe, since it has good holding ground. The island is afflicted with a scarcity of water, and with great heats, which are extremely distressing, from the excessive dryness, and the great glare reflected from the rocks. The thermometer is frequently at 110° in the shade. Upon this parched and dreary spot a British force, consisting of Sepoys and Europeans, was landed from India, in order to overcome the Arab piratical powers who molested the navigation of these seas. But they suffered severely from the united influence of the sultry climate and the want of shelter and of food and water. The island is at present under the rule of an independent Arab scheik, who pays homage to the imaums of Muscat. The town is situated close to the sea, in lat. 26. 57. 30. N.

KISHTEWAR, a district of Hindustan, in the north-eastern extremity of the province of Lahore, situated principally between the 33d and 34th degrees of N. lat. It is bounded on the north-west by the southern range of the Cashmere Hills. The country is in general hilly and covered with wood, and but thinly inhabited. It is also very cold during the winter season, and presenting few temptations to invaders, has probably on that account retained its independence. It is intersected by the river Chunaub, over which there are no bridges; and at the village of Nausman, where it is seventy yards wide, it is crossed by means of a large basket slung to a tight rope, which reaches from side to side, and along which it is pulled. Kishtewar, the capital, which is the residence of a Mahommedan chief, is situated close under the southern range of the Cashmere Mountains. Long. 75. 20. E. Lat. 34. 7. N.

KISLOVODSKOI, a fort of Asiatic Russia, in the government of Caucasus, and district of Georgiefsk. It has been erected to protect the patients who resort to the remarkable mineral water lately discovered there, which, when it is first drawn from the spring, is perfectly limpid, but soon froths like the best champaign, and also affects the tongue with an agreeable acid taste.

KISSER, a small inhabited island, in the Eastern Seas, about twenty miles in circumference, lying off the north-eastern extremity of Timor. It affords refreshments to shipping. Long. 127. 5. E. Lat 8. 5. S.

KISSING, by way of salutation, or as a token of respect, has been practised in all nations. The Roman emperors saluted their principal officers by a kiss. Kissing the mouth or the eyes was the usual compliment upon any promotion or happy event. Soldiers kissed the general's hand when he quitted his office. Fathers, amongst the Romans, had so much delicacy, that they never embraced their wives in the presence of their daughters. Near relations were allowed to kiss their female kindred on the mouth. Slaves kissed their master's hand, who used to hold it out to them for that purpose. Kissing was a customary mode of salutation amongst the Jews, as we may collect from the circumstance of Judas approaching his Master with a kiss. Relations used to kiss their kindred when dying, and when dead; when dying, out of a strange opinion that they would imbibe the departing soul; and when dead, by way of valedictory ceremony. They even kissed the corpse after it was conveyed to the pile, when it had been seven or eight days dead.

KISTNAGHERRY, a town and fortress of Hindustan, in the province of Barramahal, 105 miles west from Seringapatam. Long. 78. 23. E. Lat. 12. 32. N. It is situated on a rock 700 feet in perpendicular height, and so remarkably bare and steep that it has never been taken, except by surprise. In 1791 the British troops were repulsed in an attempt to storm this fortress. It was subsequently ceded to them, and the fortress destroyed.

KISTNAH, or Krishnah, a celebrated river in the south of India, which has its source in the Western Ghauts, not far from Sattarah, in the province of Bejapoor, which is only fifty miles in a direct line from the western sea-coast. It proceeds from hence in a south-westerly direction until it reaches Merritch, when its bulk is greatly increased by the junction of the river Worrah, formed by a variety of streamlets that fall from the Ghauts. During its course eastward it is joined by the Malpurba, Gutpurba, Beemah, and Toombuddra rivers; and pours its prodigious volume of waters by various mouths into the Bay of Bengal, at or a little to the southward of Masulipatam, where it forms the northern boundary of the Guntoor Circars. Its course, including its windings, may be estimated at 650 miles in length; and its waters fertilize the provinces of Bejapoor, Beeder, Hyderabad, and the districts of Paulnaud, Guntoor, and Condapilly. The term Krishna signifies black or dark blue, and is the name of the favourite deity of the Hindus, an incarnation of the preserving power of Vishnu. It forms the boundary of the Deccan, according to the best Mahommedan authors.

KISTNAPATAM, a town of Hindustan, on the sea-coast of the Carnatic, eighty-seven miles north from Madras. Long. 80. 16. E. Lat. 14. 19. N.

KIT, in *Music*, the name of a small violin, of such form and dimension as to be capable of being carried in a case or sheath in the pocket. Its length, measuring from the extremities, is about sixteen inches, and that of the bow about seventeen. Small as this instrument is, its powers are co-extensive with those of the violin.

Kit-Cat-Club, an association of above thirty noblemen and gentlemen of distinguished merit, formed in 1703, for the purpose of uniting their zeal in favour of the protestant succession in the house of Hanover. Their name was derived from Christopher Kat, a pastry cook, near the tavern where they met, in King's Street, Westminster, who often supplied them with tarts. Old Jacob Tonson was their bookseller. Their portraits were painted by Sir Godfrey Kneller.

KITCHEN, the room in a house where the provisions are cooked.

KITSINGEN, a city of Bavaria, and the capital of the bailiwick of the same name, in the circle of the Upper Maine. It stands on the right bank of the Maine, over which is a bridge 1000 feet long, connecting it with the suburb Etwashausen, both of which are surrounded with walls and ditches, and flanked by towers. It contains four churches, a convent, and hospital, and 784 houses, with 3850 inhabitants. It is one of the chief trading places on the river, with good wharfs and cranes. It has some manufactures of cotton, but its chief commerce is wood, wine, corn, and other productions of the soil.

KITTOOR, a town and district in the peshwa's territories, in the province of Bejapoor, twenty miles south-east from Merritch. In 1804 the renter of the district complained that it was wasted by the neighbouring feudatories, and also by the peshwa's own deputy; when, by the interference of the British, these grievances were redressed. The country is fertile.

KIUN-CHEU-FOU, a city of China, of the first rank, capital of the island of Hainan. It has a port at two miles distance, formed by a river, and much frequented by Chinese vessels. It has also a considerable trade.

KIUTAIAH, a large city of Asia Minor, and capital of Anatolia. It is situated at the foot and partly up the sides of a cluster of mountains, bounded by a fertile plain on the south. It covers a considerable extent of ground. The houses are large and well furnished, and it contains handsome fountains conveyed from the hills by aqueducts. It is not so populous as it was formerly, but it still contains between 50,000 and 60,000 inhabitants, of which number 10,000 are Armenians, and 5000 Greeks. It contains thirty public baths, fifty mosques, four Armenian and one Greek church, and twenty caravanserais. It occupies the position of the ancient Cotyæum, on the site of which there are still the ruins of a castle. Long. 29. 52. E. Lat. 39. 25. N.

KIU-TCHEOU-FOU, a town of China, in Tchekiang, of the first rank, situated on a fine river. It borders both on Kiangsee and Fotchien, from which last it is separated by a range of very rugged mountains, the ascent to which is by stairs. Long. 118. 39. E. Lat. 29. 2. N.

KIZILBACHES, a people of Asiatic Russia, in the government of Orenburg. They are not numerous, and consist chiefly of Persians who have been taken captive by the Kirghisses.

KIZILERMAK, a large river in Asia Minor, which has its rise from Mount Argish, near Kaisarieh, and, after flowing a considerable space westwards, turns to the south, and falls into the Black Sea about forty miles south of Samsoon, in long. 36. 10. E. lat. 41. 30. N. It is the ancient Halys, and is the finest river in Asia Minor.

KIZILOZIEN, or golden stream, a considerable river of Persia, which is the natural boundary between the provinces of Irak and Azerbijan. According to Rennell, it is the Gozan of the Scripture, and has its source eight or nine miles to the north-west of Sennah in Kurdistan. It runs along the north-west frontier of Irak, and passes under the Kafatan Koh, or mountain of tigers, when it is met a few miles to the east of Meanna by the Karanku, which takes its rise to the westward of that town, in the mountains of Sahund. These two rivers combined force a passage through the great range of the Caucasus, and during their course form a junction with the Shahrood, a river formed by two streams, one of which comes from the vicinity of Cazween, and the other from the mountain of Elburz, behind Teheran. The collective waters, under the designation of Sifeed Rood, or White River, so named from the foam occasioned by the rapidity of its current, flows in a meandering course through Ghilan to the Caspian Sea.

KIZLAR, a fortified town and capital of a district of the government of Caucasus, in Asiatic Russia. It is situated on the Terek, near its entrance into the Caspian Sea. It carries on a considerable trade, being a sort of entrepôt for the commerce of Astrakan with Persia and the interior of the Caucasus. It exports considerable quantities of wine, brandy, and silk; also the oil of sesamus, which answers the same purpose as the oil of olives. It was built in 1736, and is always garrisoned by two battalions, composed of the tribes who wander over the immense steppe between Kizlar and Astrakan. They are chiefly Nogays, Troukhmen, and Kalmucks. Long. 46. 29. E. Lat. 43. 31. N.

KLAGENFURT, a circle of the Austrian government of Illyria, bounded on the north and the east by Steyermark, on the south by Laybach, and on the west by Villach. It extends over 1944 square miles, and comprehends nine cities with their suburbs, fourteen market-towns, and 1626 villages and hamlets, having 27,337 houses, and 163,759 inhabitants. It is generally a mountainous district, containing very lofty peaks and ridges, but having between them many valleys beautifully picturesque and highly fertile. The chief place is the city which gives its name to the circle. Near to it is a lake whose waters form the river Glan, on whose bank it is built, and whence the northern canal is supplied with its water. It is an open town, well built, containing seven churches, two hospitals, an ursuline convent, and orphan house, besides an established lyceum and gymnasium, with schools for education in law and physic. It contains 778 houses, and 9840 inhabitants, of whom some are employed in manufactures of fine cloth, cotton goods, silks, and white lead. Long. 13. 55. 57. E. Lat. 46. 12. N.

KLAPROTH, MARTIN HENRY, a celebrated Prussian chemist, professor of chemistry, member of the Academy of Sciences at Berlin, foreign associate of the Institute of France, and of several other academies and learned societies, was born at Berlin, on the 1st of December 1743. He had received from nature an observing, serious, reflecting mind, and a capacity of patient application which nothing could tire out or exhaust. After having terminated his classical studies, he applied himself wholly to that of mineralogy, for which he had a decided predilection; but he felt that he could not make rapid progress therein without calling in the aid of chemistry, wherefore he devoted himself to these two branches of physical science. The analysis of minerals appeared to him of extreme importance with reference to the proper classification of these unorganic substances; and multiplied experiments soon afforded him the means of varying the chemical processes, and of recognizing new elements in the minerals which had already been subjected to analysis. It was thus that he discovered zircon in the jargon of Ceylon; that he demonstrated the presence of potash in volcanic productions; that he made known the sulphate of strontian; that he found potash in the leucite or white garnet; that he discovered in red schorl a new metal, which he named *titanium*, another in pechblende which he called *uranium*, and a third in the ore of white gold, to which he gave the name of *tellurium.* He also made known the molybdate of lead, and proved that the ore of red silver was a sulphuret of silver and antimony. Such are the most important of M. Klaproth's labours, those, in fact, which entitle him to rank amongst the most distinguished chemists of his age; but he published, besides, a considerable number of analyses of fossil substances, which may be found in the *Journal de Physique*, the *Annales de Chimie*, the *Journal des Mines*, and other collections of this sort. He also prepared a mineralogical system, which is mainly founded upon the constituent principles of minerals. His memoirs of chemistry have been collected and translated into French by Tassaert, Paris, 1807, in two vols. 8vo. Lastly, he composed, in conjunction with Wolf, a Dictionary of Chemistry, in four vols. 8vo; a work which was translated into French by Bouillon-Lagrange and Vagel. Klaproth greatly contributed to advance the science of mineralogy, and his researches have thrown much light on the system of Werner, as well as on the classification of Haüy. His discoveries, and, above all, his particular means of analysis, have served to guide several French chemists, who are indebted to him for part, at least, of the fortunate results which have rewarded their researches. This distinguished mineralogist died at Berlin, on the 1st of January 1817. (A.)

KLATTAU, a circle of the Austrian kingdom of Bohemia, extending over 1012 square miles, and comprehending twenty-six cities and towns, 638 villages and hamlets, with 22,058 houses, inhabited by 145,824 persons. The capital, a city of the same name, situated on the river Bradlenka, contains 527 houses, and 4126 inhabitants, who are employed in making woollen cloths and hosiery, and in working in some marble and serpentine quarries near it. Long. 13. 16. 55. E. Lat. 49. 23. 42. N.

KLAUSENBURG, a city, the capital of the Austrian province Siebenbirgen. It stands on the river Szamos, is fortified, and divided into the upper and lower towns. It contains five Catholic, one Unitarian, one reformed, and one Lutheran church, 1800 houses, and 20,600 inhabitants. It is a seat of instruction for the several sects. There is a Catholic seminary, with sixteen professors, for medicine, law, and philosophy; an Unitarian college, with a rector, three curators, eleven professors, and 300 students; a Calvinist and a Lutheran seminary. There is a china and some other manufactories; and it is the residence of many of the pure old Hungarian noble families, who maintain a theatre and other public recreations. It is in Long. 23. 29. 23. E. Lat. 46. 44. 8. N. In the Hungarian language it is called Kolosvartz.

KLEIST, Edward Christiaden, a German poet, and a soldier of distinguished bravery, was born at Zeblin, in Pomerania, in 1715. At nine years of age he was sent to pursue his studies at Cron, in Poland; and he afterwards studied at Dantzic and Königsberg. Having finished his studies, he went to visit his relations in Denmark, who invited him to settle there; and having in vain endeavoured to obtain preferment in the law, at twenty-one years of age he accepted of a post in the Danish army. He then applied himself to the study of all the sciences that have a relation to military affairs, with the same assiduity as he had before studied civil law. In 1740, at the beginning of the reign of Frederick king of Prussia, Mr de Kleist went to Berlin, and was presented to his majesty, who made him lieutenant of his brother Prince Henry's regiment; and he was in all the compaigns which distinguished the first five years of the king of Prussia's reign. In 1749 he obtained the post of captain; and in that year he published his poem on the Spring. Before the breaking out of the war, the king chose him, with some other officers at Potsdam, as companions to the young prince Frederic William of Prussia, and to eat at his table. In the first campaign, in 1756, he was nominated major of Hausen's regiment, which being in garrison at Leipsic, he had time to finish several new poems. After the battle of Rosbach, the king gave him, by an order in his own hand-writing, the inspection of the great hospital established at Leipsic. On this occasion his humanity was celebrated by the sick and wounded of both parties, and his disinterestedness was equally admired by all the inhabitants of that city. In 1758, Prince Henry coming to Leipsic, Mr de Kleist desired to serve in his army with the regiment of Hausen, which was readily granted. Opportunities of distinguishing himself could not be wanting under that great officer, and he always communicated his courage to the battalion under his command. He also served that prince at the beginning of the campaign of 1759, when he was with him in Franconia, and in all the expeditions of that army, till he was detached with the troops under General de Fink to join the king's army. On the 12th of August was fought the bloody battle of Kunnersdorf, in which he fell. His poems, which are greatly admired, are printed in the German tongue, in two volumes 8vo.

KLIN, a circle in the Russian government of Moscow, which extends over 1347 square miles, comprehending one town and 606 villages, with 8000 houses, and 62,380 inhabitants. The capital, of the same name, is a town situated on the river Sestra, with 1250 inhabitants. Long. 36. 40. E. Lat. 56. 20. N.

KLINOMETER, or Clinometer (from κλινω, which denotes inclination, and μετρον), the name of an instrument contrived by the late Lord Webb Seymour, a nobleman who devoted his life to the cultivation of science. This instrument is intended to be used by the geologist for measuring the inclination of stratified rocks, and the azimuth in which that inclination lies.

If a plummet-level be applied to an inclined plane in that position in which the edge or base of the plummet-level is horizontal, and if the edge of the plummet-level be then turned round ninety degrees in the inclined plane, the angle formed by the plumb-line with the line which is perpendicular to the edge of the plummet-level is equal to the inclination of the inclined line to the horizon. On the same principle the inclination of a plane to the horizon is measured by the klinometer.

In the klinometer represented at Plate XCIV. fig. 1, AC is a circular plate, the circumference of which is divided into 360 degrees; it has three short feet on its under surface, one of which is seen at S.

The feet on the under side of the plate are of wood, which is preferred to metal, as less liable to slip when placed on an inclined surface. The ends of the feet are in a plane parallel to the upper surface of the circular plate. The fibre of the wood is set perpendicular to the plate, to diminish the derangement which may happen by the expansion of the wood from moisture.

The arm CG is moveable round the centre of the circular plate. D is an oval hole, through which is moveable the catch of a sliding bolt; this bolt passes on the under side of the circular plate; the catch of the bolt is made flush with the surface of the circular plate. The bolt serves to fix the arm CG on the circular plate. When the instrument is to be used, C is the axis round which the arm CG turns. When the three short feet of the circular plate are placed on the inclined surface of a stratified rock, the arm which bears the spirit level EE is moved down to the lowest point of the quadrant DD, and the arm CG is moved round till the bubble stands in the middle of the level; the arm CG and the level are then in the intersection of the inclined stratum with a plane parallel to the horizon: the degree on the edge of the circular plate at which the arm CG now stands is noted, and the arm CG is to be moved round through ninety degrees of the circular plate upwards; when the arm CG is arrived at this second position, it is in the line of the greatest inclination of the stratified rock. The arm which bears the spirit level EE is then to be raised, by turning it on the centre of the quadrant; and when the bubble stands in the middle of the level, the arm will indicate, on the limb of the quadrant, the degree of inclination of the stratified rock. The magnetic needle in the box OO will, at the same time, show the magnetic azimuth, formed by the vertical plane, which contains the angle of greatest inclination; and this magnetic azimuth is to be converted into true azimuth by applying the number of degrees that the needle varies from the true meridian, at the particular time and place where the observation is made. The box OO has both the top and the bottom made of glass, so that the needle may be observed both when the instrument is placed on the upper surface, and when the instrument is applied to the under surface, of an inclined plane. When the instrument is not in use, the arm CG, with the quadrant and compass, are unfixed, and taken off from the circular plate, by withdrawing the catch of the bolt which is seen at *d*. The compass-box OO is turned round an axis, which is seen below the spirit level EE, so that the compass-box comes into the same plane with the quadrant, and then the quadrant, compass-box, and arm, CG, pack into a flat box. The circular plate ACS is now separate from the other parts of the instrument, and lies flat in another part of the box made for packing the instrument. Lord Webb Seymour's account of this instrument is published in the *Transactions of the Geological Society*, vol. iii. 1816.

KLOPPENBURG, a circle of the duchy of Oldenburg, in Germany. It extends over 612 square miles, and contains one town and fifteen parishes, with 5023 houses, and 26,964 inhabitants. The chief town, of the same name, is situated on the river Soste, containing 151 houses, and 860 inhabitants; but the whole parish has a population of 4790.

KLOPSTOCK, Frederic Theophilus, was born at Quedlinburg in 1724, and one of the most celebrated of the German poets. His father was a man of an elevated character, and a magistrate of that place, who afterwards farmed a bailiwick in the Brandenburg part of Mansfield. Klopstock was the oldest of eleven children, and having received the rudiments of education at home, he was put to the public school of Quedlinburg, where he soon became conspicuous both for bodily and mental exercises. He went to the college of the same place at the age of sixteen, where, under the tuition of an able teacher, he obtained a knowledge of, and taste for, the beauties of the best classical authors. He composed some pastorals in verse; and even at this early period he conceived the bold design of writing an epic poem, fixing at length, after much deliberation, on the Messiah, by which he has rendered his name immortal.

He commenced the study of theology at the University of Jena, in the year 1745, although in his retirement he was constantly ruminating on his great projected work already mentioned, sketching out the three first cantos. They were first written in prose, as the common measure of German verse did not accord with his own sentiments. Transported with the melody of Homer's and Virgil's strains, he determined to make trial of German hexameters, in which he succeeded so entirely to his own satisfaction, that he fixed upon this majestic verse for the whole of his poem. By his removal from Jena to Leipzig in 1746, he became acquainted with a number of young votaries of the muses, who occasionally published their essays in a paper called the *Bremen Contributions*, in which appeared the three cantos of Klopstock's Messiah, and a number of his odes, for which he was so applauded as to animate him to persevere.

He quitted Leipzig in 1748, and resided at Langensalza, where he carried on a fruitless correspondence with a beautiful young lady, who discovered no inclination to return his passion, which for some time threw a gloom over his mind. He now published ten books of his Messiah, by which he came to be known and admired all over Germany. It was an extremely popular work amongst all those who were at once the lovers of poetry and devotion. It was quoted from the pulpit by young divines, whilst others of a more stern deportment found fault with the author, as indulging too much in fiction on sacred topics.

He travelled into Switzerland in 1750, to pay a visit to Bodmer of Zurich, in consequence of an invitation, and was received with every token of respect. The sublime scenery of that country, the simplicity of its inhabitants, and the freedom they enjoyed, were admirably suited to the taste and sentiments of Klopstock. Here in all probability he would have breathed his last, had not Baron Bernstorff, who was charmed with his poetry, engaged Count Molke, after returning from France to Copenhagen, to invite him to that city, with assurances of such a pension as would make him independent. Our author accordingly set out for Copenhagen in the year 1751, by the way of Brunswick and Hamburg, at which latter place he became acquainted with a young lady, Miss Moller, of literary abilities, and a heart susceptible of tender impressions. They were soon afterwards married, and seemed destined by Providence to be one of the happiest couples upon earth; but he was early deprived of her, for she died in childbed, and her memory was sacred to Klopstock to the last hour of his existence. He lived for the most part at Copenhagen till the year 1771, after which he resided at Hamburg in the capacity of royal Danish legate, and counsellor of the margrave of Baden, who gave him a pension, and engaged him to pass the year 1775 at his palace of Carlsruhe. Such was the diffidence of our poet, that it required the most extraordinary condescension on the part of the great to make him easy in their presence.

The decline of his health made no change on the habitual tranquillity of his mind; he contemplated his approaching dissolution without any dismay, and his pious fortitude continued unshaken amidst the severest sufferings. He died at Hamburg in March 1803, being then seventy-nine years of age, and his funeral was attended with such honours as justly belonged to the greatest poet of the country.

The character of Klopstock as a poet is that of exuberance of imagination and sentiment. His sublimity, which is nearly unparalleled, makes him almost lose himself in mystical extravagance. A great critic claims for the author of the Messiah a rank amongst the very first class of poets. His odes and lyric poems are much admired by his countrymen; and his dramatic works display great force and dignity, but are thought to be better adapted to the closet than the theatre. He was also an excellent prose writer, as is fully evinced by his *Grammatical Dialogues*.

KLOSTERNEUBURG, a city of Austria, in the province of the Lower Ens. It is situated on the river Danube, and walled; but the fortifications are dilapidated. It is chiefly remarkable from an establishment for education of an ancient date, which is still maintained, consisting of seventeen professors, with a library of 25,000 volumes, and a museum. The houses are 479, with 3400 inhabitants.

KNAPSACK, in a military sense, a rough leathern bag which a soldier carries on his back, and which contains all his necessaries. Square knapsacks are most convenient, and should be made with a division to hold the shoes and other articles separate from the linen.

KNARESBOROUGH, a town of the west riding of the county of York, in the wapentake of Claro, 215 miles from London by Nottingham, and 202 by York. It is situated on the side of a hill, almost surrounded by the river Nidd. It was formerly fortified, and had a castle built in the reign of William the Conqueror. It was a burgage tenure borough, and sent two members to parliament, who are now chosen by the ten-pound house-keepers. The chief trade is the linen manufacture, which is extensive. Near the town are some mineral springs of medicinal virtue, but they are not much resorted to. A dropping well, with great petrifying power, is a curiosity, about a mile from the town. There is a market on Wednesday, which is well attended; and there are eight fairs, at which much business is transacted. The inhabitants amounted in 1801 to 3388, in 1811 to 4234, in 1821 to 5283, and in 1831 to 5296.

KNAVE, an old Saxon word, which had at first a sense of simplicity and innocence, for it signified a *boy;* Sax. *cnapa*, whence a *knave child*, or a boy, distinguished from a girl, in several old writers; afterwards it was taken for a servant boy, and at length for any servant man. It was also applied to a minister or officer who bore the shield or weapon of his superior; as *field knapa*, whom the Latins call *armiger*, and the French *escuyer* (14 Edw. III. c. 3). And it was sometimes of old made use of as a titular addition, as *Joannes C. filius Willielmi C. de Derby, knave* (22 Hen. VII. c. 37). The word is now perverted to the hardest meaning, viz. *a false, deceitful fellow.*

KNEE, in a ship, a crooked piece of timber, having two branches or arms, and generally used to connect the beams of a ship with her sides or timbers. The branches of the knees form an angle of greater or smaller extent, according to the mutual situation of the pieces which they are designed to unite.

Knee of the Head, a large, flat piece of timber, fixed edgewise upon the fore part of a ship's stem, and supporting the ornamental figure or image placed under the bowsprit.

The *knee of the head* is a phrase peculiar to shipwrights, as this piece is always called the *cut-water* by seamen, if we except a few, who, affecting to be wiser than their brethren, have adopted this expression, probably on the presumption that the other is a cant phrase or vulgarism.

Carling Knees, in a ship, those timbers which extend from the ship to the hatchway, and bear up the deck on both sides.

KNELLER, Sir Godfrey, a painter whose fame is well established in these kingdoms. He was born at Lubeck in 1648, and received his first instructions in the school of Rembrandt, but became afterwards a disciple of Ferdinand Bol. When he had gained as much knowledge as that school afforded him, he travelled to Rome, where he fixed his particular attention on Titian and the Caracci. He afterwards visited Venice, and distinguished himself so effectually in that city by his historical pictures and his portraits of the noble families there, that his reputation became considerable in Italy. By the advice of some friends he came at last to England, where it was his good fortune to gain the favour of the Duke of Monmouth, by whose recommendation he more than once painted the portrait of King Charles II. who was so pleased with his skill in doing it, that he used to come and sit to him at his house in Covent Garden piazza. The death of Sir Peter Lely left him without a competitor in England, and from that time his fortune and fame were thoroughly established. No painter could have more incessant employment, and no painter could be more distinguished by public honour. He was state painter to Charles II. James II. William III. Queen Anne, and George I., and equally esteemed and respected by them all. The Emperor Leopold made him a knight of the Roman empire, and King George I. created him a baronet. Most of the nobility and gentry had their likenesses taken by him; and no painter excelled him in a sure outline, or in the graceful disposition of his figures. His works were celebrated by the best poets in his time. He built an elegant house at Whitton, near Hampton Court, where he spent the latter part of his life, and died in 1726.

KNIEPHAUSEN, a district, formerly an independent sovereign state, but now a part of the grand duchy of Oldenburg, in Germany. During the late war the greater number of Dutch vessels were rendered neutral by the count of this district, and under the colours of Kniephausen were received in the English ports. It contains two parishes, with three churches, a strong castle, and 590 houses, with 3800 inhabitants. Though ceded to Oldenburg when mediatised, Count Bentick, the sovereign, has protested against the cession, and still maintains his claim to the dominion.

KNIFE, a well-known instrument, made for cutting, and adapted in form to the uses for which it is designed. Knives are said to have been first made in England in 1563, by one Matthews, on Fleet Bridge, London. The importation of all sorts of knives is prohibited.

KNIGHT (*eques*), amongst the Romans, a person of the second degree of nobility, following immediately that of the senators.

Knight (or *Cnecht*, Germ.), in feudal history, was originally an appellation or title given by the ancient Germans to their youth after being admitted to the privilege of bearing arms. See Chivalry.

There is scarcely a prince in Europe who has not thought fit to institute an order of knighthood; and the simple title of *knight*, which the kings of Britain confer on private subjects, is a derivation from ancient chivalry, although very remote from its source.

Knight-Service (*servitium militare*, and in law French *chivalry*), a species of feudal tenure. The knights created by this tenure differed most essentially from the knights of chivalry, though the difference seems not to have been accurately attended to by authors. The one class of knights was of a high antiquity, the other was not heard of till the invention of a fee. The adorning with arms and the blow of the sword made the act of the creation of the ancient knight; the new knight was constituted by an investment in a piece of land. The former was the member of an order of dignity which had particular privileges and distinctions; the latter was the receiver of a feudal grant. Knighthood was an honour, knight-service a tenure. The first communicated splendour to an army, the last gave it strength and numbers. The knight of honour might serve in any station whatever, the knight of tenure was in the rank of a soldier. By the tenure of knight-service the greater part of the lands in England were holden, and that principally of the king *in capite*, till the middle of the seventeenth century; and it was created, as Sir Edward Coke expressly testifies, for a military purpose, viz. for defence of the realm by the king's own principal subjects, which was judged to be much better than to trust to hirelings or foreigners. The description here given is that of knight-service proper, which was to attend the king in his wars. There were also some other species of knight-service, so called, though improperly, because the service or render was of a free and honourable nature, and equally uncertain as to the time of rendering as that of knight-service

Knights-Errant || Military Knighthood.

proper, and because they were attended with similar fruits and consequences. Such was the tenure by *grand serjeanty, per magnum servitium*, whereby the tenant was bound, instead of serving the king *generally* in his wars, to do some special honorary service to the king in person, as to carry his banner, his sword, or the like, or be his butler, champion, or other officer, at his coronation. It was, in most other respects, like knight-service, only he was not bound to pay aid or escuage; and when tenant by knight-service paid five pounds for a relief on every knight's fee, tenant by grand serjeanty paid one year's value of his land, were it much or little. Tenure by *cornage*, which was to wind a horn when the Scotch or other enemies entered the land, in order to warn the king's subjects, was, like other services of the same nature, a species of grand serjeanty.

These services, both of chivalry and grand serjeanty, were all personal, and uncertain as to their quantity or duration. But the personal attendance in knight-service growing troublesome and inconvenient in many respects, the tenants found means of compounding for it, by first sending others in their stead, and in process of time making a pecuniary satisfaction to the lords in lieu of it. By the degenerating of knight-service, or personal military duty, into escuage or pecuniary assessments, all the advantages, either promised or real, of the feodal constitutions were destroyed, and nothing but the hardships remained. Instead of forming a national militia composed of barons, knights, and gentlemen, bound by their interest, their honour, and their oaths, to defend their king and country, the whole of this system of tenures now tended to nothing else but a wretched means of raising money to pay an army of occasional mercenaries. The military tenures, with all their heavy appendages, were at length destroyed at one blow, by the statute 12 Charles II. c. 24; a statute which was a greater acquisition to the civil property of this kingdom than even *magna charta* itself, since that only pruned the luxuriances which had grown out of the military tenures, and thereby preserved them in vigour; but the statute of King Charles extirpated the whole, and demolished both root and branches.

Knights-Errant. During the prevalence of chivalry, the ardour of redressing wrongs seized many knights so powerfully, that, attended by esquires, they wandered about in search of objects whose misfortunes and misery required their assistance and succour. And as ladies engaged more particularly their attention, the relief of unfortunate damsels was the achievement they most courted. This gave birth to knights-errant, whose adventures produced romances. These were originally told as they happened. But the love of the marvellous came to interfere; fancy was indulged in the wildest exaggerations; and poetry lent her charms to the most monstrous fictions, and to scenes the most unnatural and grotesque.

Knights, in a ship, two short, thick pieces of wood, commonly carved like a man's head, having four shivers in each, three for the haulyards, and one for the top to run in. One of them stands fast bolted on the beams abaft the foremast, and is therefore called the *fore-knight;* and the other, standing abaft the mainmast, is called the *main-knight.*

Knight's *Island*, in the Pacific Ocean, the largest of three islands called the Snares by Vancouver. It was discovered in 1791. The south point is situated in Long. 166. 44. E. Lat. 48. 15. S.

KNIGHTHOOD, a military order or honour, or a mark or degree of ancient nobility, or reward of personal virtue and merit. There are four kinds of knighthood; military, regular, honorary, and social.

Military Knighthood is that of the ancient knights, who acquired it by high feats of arms. They are called *milites* in ancient charters and titles, by which they were distinguished from mere bachelors, and others. These knights were girt with a sword, and wore a pair of gilt spurs; whence they were called *equites aurati*. Knighthood is not hereditary, but acquired. It does not come into the world with a man, like nobility, nor can it be revoked.

Regular Knighthood || Knout.

Regular Knighthood is applied to all military orders which profess to wear some particular habit. Such were the knights templars, and such also the knights of Malta.

Honorary Knighthood is that which princes confer on other princes, and even on their own great ministers and favourites; such are knights of the Garter, Bath, St Patrick, Nova Scotia, Thistle, and the like.

Social Knighthood is that which is not fixed or confirmed by any formal institution, nor regulated by any lasting statutes; of which kind many orders have been erected on occasion of factions, of tilts and tournaments, masquerades, and the like.

KNIGHTON, a market-town of the county of Radnor, and hundred of its own name, in South Wales. It is a well-built town, on the side of a hill, overlooked by a lofty mountain. An old intrenchment, called Ossa Dyke, which extends from the Dee to the Wye, runs at the bottom of the town, and is said to have formed the boundary between England and Wales. There is a market, which is held on Thursday. The inhabitants amounted in 1801 to 785, in 1811 to 952, in 1821 to 1000, and in 1831 to 1076.

KNITTLINGEN, a market-town of the bailiwick of Maulbroun, and circle of the Neckar, in the kingdom of Wirtemberg. It contains 304 houses and 2380 inhabitants.

KNOLLES, Richard, was born in Northamptonshire about the middle of the sixteenth century, and educated at Oxford, after which he was appointed master of the free school at Sandwich in Kent. He composed *Grammaticæ Latinæ, Græcæ, et Hebraicæ, compendium, cum radicibus*, London, 1606, and sent many excellent scholars to the universities. He also spent twelve years in compiling a history of the Turks, which was first printed in 1610. It is called the General History of the Turks, from the first beginning of that nation to the rising of the Ottoman family. He died in 1610, and this history has been since continued by several hands; but the best continuation is that by Paul Ricaut, consul at Smyrna, folio, London, 1680. Knolles wrote also the Lives and Conquests of the Ottoman Kings and Emperors to the year 1610, which was not printed till after his death in 1621, to which time it was continued by another hand; and, lastly, a Brief Discourse of the greatness of the Turkish empire, and wherein the greatness of the strength thereof consisteth.

KNOUT, the name of a punishment inflicted in Russia, with a kind of whip called *knout*, and made of a long strap of leather prepared for this purpose. With this whip the executioners dexterously carry off a slip of skin from the neck to the bottom of the back, laid bare to the waist, and, repeating their blows, in a little while rend away all the skin of the back in parallel stripes. In the common knout the criminal receives the lashes suspended on the back of one of the executioners; but in the great knout the criminal is raised into the air by means of a pulley fixed to the gallows, and a cord fastened to the two wrists tied together; a piece of wood is placed between his two legs also tied together; and another of a crucial form under his breast. Sometimes his hands are tied behind his back; and when he is pulled up in this position his shoulders are dislocated. The executioners can make this punishment more or less severe; and, it is said, are so dexterous, that when a criminal is condemned to die, they can make him expire at pleasure, either by one or several lashes.

KNOX, JOHN, the great reformer of Scotland, was born at the village of Gifford in Haddingtonshire in the year 1505. His father is said, though perhaps without foundation, to have been descended from the family of Ranferly, in the same county. The name of his mother was Sinclair; and some of his letters, written in seasons of danger, were subscribed John Sinclair. Whatever might be the lineage or the situation of the father, the son was enabled to obtain the benefit of a liberal education, such as his native country could then afford. After having been instructed in the Latin language at Haddington school, he was in the year 1521 sent to the university of Glasgow, where philosophy and divinity were taught by John Mair, a celebrated schoolman. The Greek and Hebrew languages were not then publicly taught in Scotland; but the former of these he acquired when he was yet in the vigour of life, and the latter during the period of his continental exile. It is not sufficiently ascertained that he took a degree; but if it be correctly stated that he publicly taught philosophy in this university, and afterwards at St Andrews, we are perhaps to infer that he was a master of arts.

He soon felt himself dissatisfied with the dry and barren speculations of scholastic philosophy and scholastic theology, and was gradually conducted to a more edifying course of enquiry. Not contented, as his excellent and lamented biographer has stated, with the extracts "from ancient authors, which he found in the writings of the scholastic divines and canonists, he resolved to have recourse to the original works. In them he found a method of investigating and communicating truth, to which he had hitherto been a stranger, and the simplicity of which recommended itself to his mind, in spite of the prejudices of education, and the pride of superior attainments in his own favourite art. Among the fathers of the Christian church, Jerom and Augustine attracted his particular attention. By the writings of the former, he was led to the Scriptures as the only pure fountain of divine truth, and instructed in the utility of studying them in the original languages. In the works of the latter, he found religious sentiments very opposite to those taught in the Romish church, who, while she retained his name as a saint in her calendar, had banished his doctrine, as heretical, from her pulpits. From this time, he renounced the study of scholastic theology; and although not yet completely emancipated from superstition, his mind was fitted for improving the means which Providence had prepared, for leading him to a fuller and more comprehensive view of the system of evangelical religion. It was about the year 1535 when this favourable change commenced; but it does not appear that he professed himself a protestant before the year 1542." The reformed doctrines had been preached to his benighted countrymen by Patrick Hamilton, abbot of Ferme, who was allied to the royal family, and who had the higher honour of being the proto-martyr of Scotland to the protestant faith. On the last of February 1528, he was most inhumanly committed to the flames in the archiepiscopal city of St Andrews. But the seed which he had thus moistened with his blood, sprung from the ground with a degree of vigour which the foulest blasts of persecution were found incapable of withering. The new opinions were gradually adopted by men of learning as well as of rank. Between the years 1530 and 1540, a considerable number of victims was doomed to a cruel death, while others escaped the fangs of their persecutors, and sought refuge in England and on the continent. Several of these exiles, and among the rest George Buchanan and Alexander Aless, were men distinguished by their talents and learning, who obtained preferment in foreign universities, and there reflected credit on their native country.

During those times of persecution, Knox was engaged in teaching philosophy in the university of St Andrews, though it does not clearly appear that he held the office of a regent or professor. Several individuals of his acquaintance had embraced the reformed doctrines: the force of truth gradually affected his own mind, and he arrived at complete conviction in the year 1542, having then attained the age of thirty-seven. As he began to recommend to his pupils a more rational and edifying method of study, he excited some suspicions of heretical pravity; but when he proceeded so far as to expose certain corruptions of the church, he speedily found it necessary to change his place of residence. Having retired to the south of Scotland, and there avowed his adherence to the cause of reformation, he was declared a heretic, and was degraded from his orders. Nor was Cardinal Beaton satisfied with this more canonical form of procedure: he employed assassins to co-operate in the same design of supporting the church, but his intended victim found shelter and protection in his native county, under the roof of Hugh Douglas of Longniddry, a gentleman who had adopted the same opinions. Here he was retained in the capacity of a domestic tutor; and the son of another protestant, John Cockburn of Ormiston, was likewise committed to his charge. He communicated religious instruction, not only to his pupils, but also to the other members of the family, and to the people of the immediate neighbourhood. He was accustomed to catechise them in a chapel at Longniddry, and there at stated times to read and explain a portion of the Scriptures. When religious instruction was so scanty, and access to the fountain of sacred knowledge so difficult, the services of so faithful a labourer must have been of no small value. About this period, he received a new impulse from the public and private instructions of George Wishart, who returned to his native country in the year 1544. He had been driven into exile by the bishop of Brechin, for the crime of reading lectures on the Greek Testament at Montrose, and during several years had resided in the university of Cambridge. "Excelling all his countrymen at that period in learning, of the most persuasive eloquence, irreproachable in life, courteous and affable in manners, his fervent piety, zeal, and courage in the cause of truth, were tempered with uncommon meekness, modesty, patience, prudence, and charity. In his tour of preaching through Scotland, he was usually accompanied by some of the principal gentry; and the people, who flocked to hear him, were ravished with his discourses. To this teacher Knox attached himself, and profited greatly by his sermons and private instructions. During the last visit which Wishart paid to Lothian, Knox waited constantly on his person, and bore the sword, which was carried before him from the time that an attempt was made to assassinate him in Dundee. Wishart was highly pleased with the zeal of his faithful attendant, and seems to have presaged his future usefulness, at the same time that he laboured under a strong presentiment of his own approaching martyrdom."[1]

Wishart was brought to the stake at St Andrews on the 1st of March 1546, and his persecutor, the blood-stained cardinal, was not long permitted to survive. On the 29th of the ensuing May, he was surprised in his castle by a small and resolute band of conspirators, whom his misdeeds had roused to acts of desperation. Having put him to death, they kept possession of his strong-hold, and procuring assistance from England, they sustained a regular siege from an army collected by the regent Arran. Many protestants, who had no participation in the conspiracy, sought refuge in the castle; and among these were Sir David Lindsay and Henry Balnaves, whose names are familiarly known to all who are acquainted with the literary his-

[1] M'Crie's Life of Knox, vol. i. p. 41, 5th edit. Edinb. 1831, 2 vols. 8vo.

tory of that age. Knox, being among the number of the proscribed, was persuaded by Douglas and Cockburn to follow the example. He was accompanied by his pupils, and continued his religious as well as his literary instructions. In the chapel of the castle, he read lectures on portions of the Scriptures; and so favourable an opinion was formed of his talents and attainments, that he was earnestly solicited to officiate as the colleague of John Rough, chaplain to the garrison. It was not without much reluctance that he obeyed the call; but having undertaken this office, he acquitted himself with equal ability and zeal. He occasionally preached in the parish church, as well as in the chapel of the castle, and the popish clergy were at length roused to some degree of counter-exertion: it was arranged that the most learned men of the abbey and university should every Sunday preach in their turn, partly with the view of excluding the protestant ministers from the pulpit, and partly with that of conciliating the affections of the people, whose edification they had too long disregarded. Knox and his colleague were summoned to a public disputation, held in the presence of Winram the sub-prior, who was vicar-general during the vacancy of the see, and who was secretly inclined to the reformed doctrines. He did not himself enter into much discussion, and he was very feebly supported by a Franciscan friar, named Arbuckle, who was finally driven to the desperate averment "that the apostles had not received the Holy Ghost when they wrote the epistles, but they afterwards received it, and ordained ceremonies." It was more easy for this father to abandon the inspiration of the holy Scriptures, than to relinquish the vain ceremonies of the church: so customary has it generally been for mankind to adore the bungling work of their own hands.

During the short period of his ministrations at St Andrews, many of the citizens renounced the errors of popery, and publicly testified the change of their religious opinions, by partaking of the communion according to the rite of the reformed church. But the protestants could not long retain possession of the castle. At the end of June 1547, a considerable reinforcement arrived from France, and enabled the regent to invest the place by sea and land: the garrison made a brave resistance, but after an interval of a month was reduced to the necessity of accepting terms of capitulation from Leo Strozzi, the commander of the foreign auxiliaries. It was stipulated that their lives should be spared, that they should be removed to France, and that such of them as declined entering into the French service should be conveyed to any other country except Scotland. Rough had previously emigrated to England, and there he suffered martyrdom in the year 1557. Knox, sharing the fate of his companions, was conveyed on board one of the French ships, which cast anchor before Rouen; but the terms of the capitulation were grossly violated, and, at the instigation of the pope and the Scottish clergy, they were treated as prisoners of war. The principal gentlemen were committed to close custody in Rouen, Cherbourg, Brest, and Mont St Michael; while Knox and some others were sent on board the galleys, and after being loaded with chains, were compelled to labour at the oar. Here they were subjected to many other indignities; but in spite of every hardship and every threat, not one of their number could be impelled to renounce his faith. During the ensuing winter, the galley in which he was confined lay in the river Loire; and, in the summer of 1548, it sailed for Scotland, and during a considerable period lingered on the eastern coast, for the purpose of intercepting English vessels. The hardships to which he was now subjected produced a very serious effect upon his health: he was seized with a violent fever, and no hope was entertained of his recovery. He however regained his strength, and during his captivity had sufficient energy of mind to compose more than one religious treatise. His treatise on prayer, written during this season of affliction, was afterwards published. Having endured a captivity of nineteen months, he was restored to liberty in February 1549. Of the circumstances which led to this event, various accounts have been given; but according to Dr M'Crie, "it is more than probable that he owed his deliverance to the comparative indifference with which he and his brethren were now regarded by the French court, who, having procured the consent of the parliament of Scotland to the marriage of Queen Mary to the dauphin, and obtained possession of her person, felt no longer any inclination to revenge the quarrels of the Scottish clergy."

Knox immediately directed his course to England, where his merits and his sufferings were neither unknown nor unregarded. Soon after he made his appearance in London, he received an appointment to officiate at Berwick, where he began to preach with his characteristic fervour and zeal. He exposed the errors of popery with an unsparing hand, and his labours seem to have been attended with no inconsiderable success. The tendency of his zeal was not however calculated to recommend him to the bishop of the diocese, Dr Tonstall, who, although a man of elegant learning, was deeply infected with the ancient superstition. Having been accused of asserting that the sacrifice of the mass is idolatrous, the preacher was cited to appear at Newcastle on the 4th of April 1550, before the bishop of Durham, and to give an account of his doctrine. This prelate was attended by several of his clergy, as well as by various laymen, and a large number of spectators was attracted by the peculiar circumstances of the investigation. Knox entered into a copious defence of his opinions, and with the utmost boldness proceeded to demonstrate that the mass is a superstitious and idolatrous substitute for the genuine sacrament of the Lord's supper. The bishop, though he probably listened with surprize and indignation, did not venture to inflict any ecclesiastical censure; and the fame of the obnoxious preacher was extended by this attempt to restrain the boldness of his attacks on the errors of the falling church. Having remained at Berwick till the close of the year, he was afterwards removed to Newcastle. In December 1551, he was appointed one of King Edward's chaplains in ordinary, with an annual salary of forty pounds, which at that period was no mean provision. The chaplains were six in number; two of whom were to be in constant residence at court, while the other four were employed in preaching in different parts of the kingdom. In the course of this year, the Book of Common Prayer was subjected to a revisal, of which it stood in considerable need; and Knox having been consulted among other divines, was chiefly instrumental in procuring a material alteration in the communion service, which at first was too favourable to the doctrine of the real presence. One deep vestige of this doctrine is still preserved in the kneeling posture of the communicants, which manifestly derives its origin from the popish adoration of the host.

The freedom of his discourses in the pulpit gave offence to various individuals, and among others to the duke of Northumberland, warden general of the northern marches; and having been accused of high misdemeanours, he was cited to appear before the privy council, which at that period possessed an extensive and ill-defined jurisdiction. But the malice of his enemies was altogether ineffectual, and this call to the metropolis was followed by consequences very different from those which they anticipated. He was fully cleared from every imputation of blame; and having been employed to preach at court, he made so favourable an impression on the young king that he expressed his anxiety to promote him in the church. It was resolved by the council that during the following year he should preach in London and the southern counties. Having returned for a short time to Newcastle, he accordingly repaired to the metropolis in the beginning of April 1553. Archbishop Cranmer had previously been directed by the council to present him to the rectory of All-Hallows; but Knox declared that in the existing state of the church he could not conscientiously accept of any preferment. He was again summoned before the council, where he gave an unreserved explanation of his sentiments on that subject. Nor could the promise of much higher promotion induce him to disregard the admonitions of a scrupulous conscience: the king, with the advice of his council, made him an offer of a bishopric; but instead of availing himself of so favourable an avenue to worldly honours, he declared the office of a bishop, as exercised in the English church, to be destitute of divine authority. It is sufficiently evident that he considered that establishment as but imperfectly reformed from the errors of popery; and that, in his estimation, the new prelacy, retaining all the proud trappings, as well as the political character of the old, was very widely removed from the simplicity of an evangelical church. The premature death of the king, on the 6th of July 1553, was fatal to the further progress of reformation, and a cloud of spiritual darkness again overshadowed the land.

During his residence at Berwick, Knox had formed a lasting attachment to Marjory Bowes. Her father was Richard, the youngest son of Sir Ralph Bowes of Streatlam; her mother was Elizabeth, a daughter and coheiress of Sir Roger Aske of Aske. The match was cordially approved by the mother of the young lady, but having been opposed by her father, it was not concluded till after a considerable interval. After the king's death, he had some intention of settling at Berwick, or in the immediate neighbourhood; but he speedily discovered that he could not safely reside in a kingdom ruled by so bigoted and cruel a sovereign. He therefore sailed for France, and landed at Dieppe on the 20th of January 1554. Having lingered there till the last day of February, he pursued his solitary way through France, and arrived in Switzerland; but in the beginning of the ensuing month of May, he retraced his steps to Dieppe with the view of obtaining intelligence from his friends in England. At that period, the intercourse between different countries was slow and precarious; nor was this the only occasion on which he returned to the same place for the same purpose. While he continued to reside on the continent, he received remittances from his friends in Scotland as well as in England, but his provision was neither certain nor ample. Geneva became for some time the chief place of his abode, and here his exile was cheered by the friendship of one of the most illustrious men of the age. Calvin had now attained to the summit of his reputation. They embraced the same opinions with respect to the leading doctrines of the Christian faith, and in their personal character they exhibited several conspicuous points of resemblance. In their notions of ecclesiastical polity they preserved the same agreement; and the authority of Knox, supported by that of Calvin, has contributed to establish in this country a simple mode of discipline and worship, to which our ancestors adhered with unconquerable resolution, and in support of which many of them were found ready and willing to shed their blood.

The leisure which he enjoyed at Geneva was profitably spent in study, to which he devoted himself "with all the ardour of youth, although his age now bordered upon fifty. It seems to have been at this time that he made himself master of the Hebrew language, which he had no opportunity of acquiring in early life." Many pious and learned men had now been driven from England by the unrelenting cruelty of Queen Mary, and most of them sought refuge in the protestant states of Germany and Switzerland. Those who resorted to the imperial city of Frankfort, were allowed the joint occupancy of a place of worship; and it was unanimously resolved to discontinue the use of the surplice, the litany, the audible responses, and some other superfluities which might rather excite the surprize than the approbation of their foreign brethren. Having determined to elect three pastors, they sent a letter of invitation to Knox, subscribed by twenty-one of their number, at the the head of whom stands John Bale, the exiled bishop of Ossory. It was not without some degree of reluctance that he consented to leave his retreat at Geneva; he however repaired to Frankfort in the month of November 1554, and entered upon the duties of his new charge, but his connexion with this congregation proved a source of great uneasiness and mortification. Various dissensions which arose among its members, were chiefly occasioned by a difference of opinion as to the propriety of adhering to the English service; and those dissensions were greatly fomented by Dr Cox, who had been preceptor to King Edward, and who afterwards became bishop of Ely. In the progress of the controversy, Knox appears to have acted with dignity and moderation, but the ardent votaries of the liturgy were not easily diverted from their purpose; for when all other expedients failed, two of their number, with the approbation of others, sought a private interview with the magistrates, and accused him of treason against the emperor Charles, his son Philip, and his aunt the queen of England. This extraordinary charge was founded upon certain passages in his tract published in 1554, under the title of "A Faythfull Admonition unto the Professours of Gods Truthe in England." Of the futility of such an accusation the magistrates were sufficiently aware; but they nevertheless deemed it advisable for him to withdraw from Frankfort, and he availed himself of the suggestion which they conveyed to him. On the evening of the 25th of March 1555, he delivered a farewell discourse to about fifty members of the congregation; and on the following day they accompanied him several miles on his journey. He immediately returned to Geneva, and he experienced a cordial welcome from Calvin. There he continued till the month of August, when he again proceeded to Dieppe; and having embarked in a vessel bound for Britain, he landed near the eastern border of the two kingdoms about the end of autumn. On reaching Berwick, he found his wife and mother living in comfortable circumstances. With them he remained for some time, and afterwards pursued his journey to Edinburgh, where he took up his abode with a citizen named John Syme, to whose house the friends of reformation repaired as soon as they were aware of Knox's arrival.

Notwithstanding the rigour of the penal laws, the votaries of the protestant cause were not entirely extirpated or dispersed. The queen dowager, Mary of Loraine, having succeeded in her attempt to supplant the earl of Arran, had been appointed regent on the 10th of April 1554. She was sufficiently disposed to continue the corruptions of the church, but several prudential considerations restrained her from pursuing more violent measures. Some of the protestants who were driven from England by the atrocities of Mary, a worthy daughter of Henry the Eighth, were permitted to live in Scotland without molestation, and even to meet, though with some degree of privacy, for the purpose of worshipping God according to the dictates of their own conscience. William Harlow, who afterwards became minister of St Cuthbert's, is mentioned as the first preacher who returned from the south at this critical period; and, in different parts of the country, he continued his ministrations till the final establishment of the reformation. His endeavours were ably seconded by John Willock, whom Knox found residing at Edinburgh as an envoy from Anne duchess of Friesland; for he had been entrusted with a commission for arranging the commercial relations between the two countries. He was born in Ayrshire, and had originally been a Franciscan friar; but speedily quitting his monastery and renouncing the mass-book, he sought refuge in England, where he was appointed chaplain to the duke of Suffolk. After the death of the young king, he was again compelled to change his place of residence, and he then settled in the town of Embden, and followed the practice of physic. He thus became known to the duchess, who was favourably inclined to the reformation of religion; and his mission to his native country afforded him peculiar opportunities of promoting that cause in which he felt so deep an interest. He became known to the leaders of the protestant party, who privately resorted to him from the desire of religious edification. At this period, few individuals had openly renounced the Romish creed; and of those who were most inclined to the protestant doctrines, very few had ventured to discontinue their attendance at mass. Knox was deservedly scandalized at this want of firmness and consistency: a meeting, attended by William Maitland of Lethington and other leaders of the party, was held for the avowed purpose of discussing the lawfulness of such compliances; and Knox succeeded in his attempt to convince them that all participation in the worship of the Romish church was to be avoided by those who were convinced of her gross errors. Nor were his exertions confined to the metropolis. He accompanied John Erskine of Dun to his seat in the neighbourhood of Montrose; and during a visit of a month he preached every day, being attended by the principal persons of the adjacent district. On his return to the south, we find him residing at Calder-house, the seat of Sir James Sandilands, afterwards Lord Torphichen, an early, zealous, and consistent friend of the reformation. In the hall of this baron, who was preceptor in Scotland of the knights of St John of Jerusalem, he preached and administered the communion. Here his ministrations were attended by several persons of distinction; and among these were Archibald, Lord Lorne, afterwards earl of Argyle, John, Lord Erskine, afterwards earl of Mar, and James Stewart, prior of St Andrews, afterwards earl of Moray; all of whom received religious impressions which influenced the future course of their lives. Early in the subsequent year, 1556, he was accompanied to the district of Kyle by Lockhart of Bar and Campbell of Kineancleuch. This division of Ayrshire had been the principal seat of the Lollards in Scotland, and it then contained many friends of the purer religion. They were not therefore unprepared for his reception: he preached not only in the town of Ayr, but likewise in the houses of Bar, Kineancleuch, Carnell, Ochiltree, and Gadgirth, and in several of these places the holy communion was now dispensed. Before Easter, he paid a visit to Finlayston, the residence of Alexander earl of Glencairn, one of the most strenuous friends of the reformation. In this baronial castle he also preached and administered the sacrament. Returning to Calder-house, he next determined to visit his friends in the north; and during his second residence at Dun, he was emboldened to preach in a more public manner. Many gentlemen of that vicinity made an open profession of the reformed faith; and, in order to strengthen their cause, they entered into a solemn engagement to renounce the communion of the popish church, and, to the utmost of their ability, to promote the pure preaching of the gospel. "This," says Dr M'Crie, "seems to have been the first of those religious bonds or covenants, by which the confederation of the protestants in Scotland was so frequently ratified."

As he now begun to preach more openly, the ecclesiastics felt a natural alarm for the safety of a tottering church; and the friars testified their zeal by urging the bishops to proceed with rigour against such an offender. He was accordingly cited to appear before an assembly of the clergy, to be held at Edinburgh in Blackfriars church, on the 15th of May; but when they found that he did not shrink from this discussion, and that he was supported by some persons of influence, they sought a pretext for superseding the citation, on the ground of its informality. On the very day which had been appointed for his appearance, he preached in the bishop of Dunkeld's house to a much larger auditory than had previously attended him in Edinburgh; and during the ensuing ten days, he regularly preached twice a-day in the same place, without being exposed to any molestation. About this period the Earl Marischal attended one of his evening discourses; and it may be regarded as a proof of his favourable impression that he united with the earl of Glencairn in an earnest request, that Knox would address to the queen regent such a letter as might induce her to extend her protection to the protestant preachers. A letter was accordingly addressed to her, and it was delivered by the earl of Glencairn, but it does not appear to have produced any change in her sentiments. This letter he afterwards published, with some additions. In the mean time he received from the English congregation at Geneva an invitation to become one of their pastors. He readily listened to their call, and made arrangements for removing thither, accompanied by his wife, as well as by her mother, who had now lost her husband. He embarked them on board a vessel bound for Dieppe, and paid another visit to the several places where he had disseminated the truth of the gospel. He visited the earl of Argyle at Castle Campbell, and there he repeatedly preached to such an auditory as could be assembled. Having thus made no inconsiderable progress in preparing his countrymen for a more general reception of the reformed doctrines, he took his leave in the month of July 1556, and joining his family at Dieppe, he again directed his course to Geneva. His colleague in his new office was Christopher Goodman, B.D., an Englishman, who afterwards became a clergyman of the church of Scotland.[1] Their congregation chiefly consisted of the exiles who had withdrawn from Frankfort in consequence of the dissensions already mentioned. The two pastors lived together on terms of the greatest cordiality. Knox likewise enjoyed the friendship of Calvin and Beza; and the two years which he spent in this vocation are described as the most tranquil of his public life. At this period was published a directory for worship and discipline, frequently described as the Order of Geneva; but it had been composed at Frankfort by Knox, Whittingham, Fox, Gilby, and T. Cole. The same directory was afterwards adopted by the reformed church of Scotland.[2]

When the Scotish clergy were apprized of his having

[1] Brook's Lives of the Puritans, vol. ii. p. 123.

[2] The Forme of Prayers and Ministration of the Sacraments, &c. vsed in the Englishe Congregation at Geneua, and approued by the famous and godly learned man, Iohn Caluyn. Imprinted at Geneva by Iohn Crespin, 1556, 8vo. This part of the volume consists of 93 pages; which are followed by "One and fiftie Psalmes of David in Englishe metre, wherof 37 were made by Thomas Sternehold, and the rest by others. Conferred with the hebrewe, and in certeyn places corrected as the text and sens of the Prophete required." Next follows "The Catechisme, or manner to teache children the Christian religion, wherin the Minister demandeth the question, and the childe maketh answere. Made by the excellent Doctor and Pastor in Christes Churche, Iohn Caluin." The first Scotish edition, which contains some modifications and considerable additions, bears the subsequent title: "The Forme of Prayers and Ministration of the Sacraments, &c. vsed in the English Church at Geneua, approued and receiued by the Churche of Scotland: whereunto besydes that was in the former bokes, are also added sondrie other prayers, with the whole Psalmes of Dauid in English meter." Printed at Edinbvrgh by Robert Lekprevik, 1565, 8vo. The Catechisme has a separate title, bearing the date of 1564. Of this work there are many other editions, several of which were printed in Holland. One edition is entitled

quitted the kingdom, they renewed the citation for his appearance; and those who had no inclination to encounter such a disputant, now found themselves at liberty to proceed against him as a contumacious heretic. He was accordingly condemned to suffer death by fire; and as the sentence could not be executed on his person, it was executed on his effigy, which was in due form committed to the flames at the cross of Edinburgh. From this sentence he prepared an appeal, which was afterwards printed under the title of "The Appellation of John Knoxe from the cruell and most unjust sentence pronounced against him by the false Bishoppes and Clergie of Scotland." In the course of the year which followed his return to Geneva, two citizens of Edinburgh, James Syme, and James Baron, were the bearers of an invitation for him to resume his evangelical labours in his native country. They were furnished with credentials from the earl of Glencairn, and the lords Erskine, Lorne, and James Stewart. After consulting Calvin and the other ministers of Geneva, he determined to devote himself to this honourable and dangerous service; and he again pursued his way to Dieppe, where he arrived in October 1557. He had however the mortification of receiving letters which entirely disconcerted his plan; for he was informed that some of the protestants already repented of the invitation which had been sent to him, and that the great body of them seemed to waver in their purpose. He lost no time in addressing a letter to the noblemen who had subscribed the credentials; and it may easily be supposed that he did not fail to upbraid them for their want of firmness and consistency. In a similar strain, he likewise wrote to Erskine of Dun, Wishart of Pittarow, and to some other individuals of the protestant party. He lingered in France to await the course of events; and as he was familiarly acquainted with the French tongue, his talents as a preacher were not in the mean time unemployed. About this period, he paid a visit to Lyon, and he is known to have preached at Rochelle. A protestant congregation had recently been formed at Dieppe; and he was now elected one of its pastors, being associated with Delaporte. So successful were their exertions, that some of the principal persons of the town were induced to renounce popery, and a general improvement began to be produced in the morals of the inhabitants. Discouraged by the aspect of affairs in Scotland, he at length determined to revisit Geneva, where he again made his appearance in the beginning of the year 1558. It was at this period that some of the most learned members of his congregation were engaged in preparing an English version of the Bible, and he is said to have had some share in so laudable an undertaking.[1] The New Testament was printed at Geneva in 1557, and the entire Bible in 1560. This version, commonly called the Geneva Bible, is allowed by competent judges to possess great merit; and, in the opinion of Dr Geddes, it is generally superior to the version executed under the authority of King James. Of the former version, says Dr M'Crie, it is evident that his translators made great use; "and if they had followed it still more, the version which they have given us would, upon the whole, have been improved."

In the course of the year 1558, Knox published three different works. One of these was the Appellation. Another, which has also been mentioned in a former page, was "The copie of a Lettre delivered to the Ladie Marie, Regent of Scotland." The third and most remarkable of these tracts bears the title of "The first Blast of the Trumpet against the monstruous Regiment of Wemen." This anonymous work, directed against the political government of females, attracted a very considerable degree of attention. It was speedily answered by John Aylmer, who in due time became bishop of London. The doctrine of Knox as to the inexpediency of female rule was afterwards controverted by David Chalmers of Ormond, and by John Lesley, bishop of Ross. Whatever opinion may be formed of his theory, it must at least be admitted that, either in England or Scotland, he had seen nothing to reconcile him to the practice; and, in one of those countries, the regimen of a woman might with too much justice be termed monstrous. His literary labours were interrupted by the renewal of an invitation from the Scotish protestants; and at the beginning of the year 1559, he bade a final adieu to Geneva, having previously been presented with the freedom of the city. Leaving his family behind, he once more proceeded to Dieppe, where he arrived in the month of March; and having ascertained that he would not be permitted to pass through England, he embarked for Leith on the 22d of April, and was safely landed on the 2d of the following month.

The popish church of Scotland was now approaching its crisis, which the presence of Knox had no small tendency to hasten. The queen regent, who for some time thought it necessary to dissemble her real sentiments, had lately evinced a fixed resolution to oppose the reformation with all the weight of her authority; and the fires of persecution had been rekindled by Hamilton, the profligate archbishop of St Andrews. Walter Mill, a venerable priest, who had attained the age of eighty-two, was brought to the stake on the 28th of August 1558. This atrocious execution had such an effect in rousing the popular indignation, that the dread of the civil or ecclesiastical authority could no longer restrain the people from making an open avowal of their adherence to the reformed doctrines; while their spiritual guides, Harlow, Douglas, Methven, and a few others, began, with less fear of detection, to preach and to administer the sacraments. In the month of October, Willock again returned from Embden, and brought a new accession of talent and zeal. The death of the English queen, which took place on the 17th of November 1558, was another event that produced considerable influence on the affairs of the neighbouring states. The queen regent was however prepared to adopt the most violent measures. Several of the preachers, Willock, Harlow, Methven, and Christison, were cited to appear at Stirling before the high court of justiciary on the 10th of May, that is, eight days after Knox's return; and very soon after his arrival had been announced to Mary, he was proclaimed a rebel and an outlaw. The four preachers were outlawed for non-appearance, and a fine was levied on their sureties. After remaining a single day in the metropolis, he hastened to Dundee, where the chief protestants of Angus and Mearns were then assembled. They proceeded to Perth, and there he preached a sermon against the idolatry of the mass and of image-worship. After the conclusion of the service, a riot was casually excited among the common people; and, before it was terminated, the monasteries of the Dominican and Franciscan friars, with that of the Carthusian monks,

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"The CL. Psalmes of David in prose and meeter: with their whole vsuall Tunes, newly corrected and amended. Herevnto is added the whole Church Discipline, with many godly Prayers, and an exact Kalendar for xxv. yeeres: and also the Song of Moses in meeter, neuer before this time in print." Edinburgh, printed by Andro Hart, anno 1615, 8vo. Instead of Calvin's Catechism, this edition includes "A Catechisme of Christian Religion. Appointed to be printed for the vse of the Kirke of Edinbvrgh." A more recent edition bears the title of "The Psalmes of David in prose and meeter: with their whole Tunes in foure or mo parts, and some Psalmes in Reports. Whereunto is added many godly Prayers and an exact Kalendar for xxv. yeeres to come." Printed at Edinburgh by the Heires of Andrew Hart, anno Dom. 1635, 8vo.

[1] See Archbishop Newcome's Historical View of the English Biblical Translations, p. 68. Dublin, 1792, 8vo.

Knox.

were totally demolished. The queen, who was probably glad of such a pretext, collected a considerable army, and advanced upon Perth; but she found the protestants so well prepared for resistance, that she did not hazard an attack. She proposed and ratified terms of accommodation, which she speedily shewed a strong disposition to disregard. In order to ascertain the strength of their party, and to consolidate its union, they formed a religious bond or covenant, which received many signatures in different parts of the kingdom. From this period, they began to be distinguished by the name of the Congregation, and their noble leaders were commonly described as the Lords of the Congregation.

On his return from Perth, he preached at Anstruther and Craill. Disregarding the admonitions of his friends, and the threats of the archbishop, he next preached in the cathedral of St Andrews, having selected the appropriate subject of our Saviour's driving the profane traders from the holy temple. On the three ensuing days he lifted up his warning voice in the same place; and so signal was the success which attended his efforts, that the magistrates and the inhabitants resolved to establish the reformed worship in that city; the pictures and images were removed from the churches, and, on the 14th of June, the monasteries were defaced. He reached the capital in the end of the same month: on the day of his arrival he preached in St Giles's, and on the following day in the Abbey church. On the 7th of July, the body of the protestant inhabitants of Edinburgh elected him as their minister, nor did he decline the invitation. His wife followed him from Geneva; and her mother, after visiting her relations in England, likewise came to end her days in Scotland. But he was soon disturbed in his new functions, in consequence of the military occupation of the city by the troops of the queen regent. He now made an extensive circuit in the southern and eastern districts of the kingdom, visiting Kelso, Jedburgh, Dumfries, Ayr, Stirling, Perth, Brechin, Montrose, Dundee, and St Andrews; nor can we doubt that the impressions produced by such a missionary were great and beneficial. After this period he was deeply engaged in the political as well as the ecclesiastical transactions of the Congregation; and the vigour of his talents, with the decision of his character, was conspicuously displayed in the steps which led to the establishment of the reformed religion. Knox, as well as Willock, concurred in advising the suspension of Mary from the office of regent. For the space of twelve months, the kingdom was infested with a civil war, in which French and English troops supported their respective allies. The contest, which had not been marked by many of the usual atrocities of intestine warfare, terminated in the month of July 1560. Parliament soon afterwards assembled; and in the course of a few days the reformed religion was established by the authority of the legislature.

Knox, after officiating for several months at St Andrews, had returned to Edinburgh at the end of April, and continued to exercise his functions during the siege of Leith. Before the close of the year, he was visited with a severe domestic affliction in the loss of his wife, who left two children of tender years. The young queen returned from France on the 21st of August 1561. Not many days after her arrival, she sent for the reformer, of whose powerful influence she must have been fully aware; but neither this nor any of their subsequent interviews produced the effects which she seems to have anticipated. Such topics as Mary introduced he discussed with undaunted freedom, though it cannot with justice be affirmed that he treated her with incivility. She certainly did not overawe him with her royal presence, or render him less disposed to use his utmost endeavour in destroying the fabric of ancient superstition. The Scottish reformation differed in many respects from that of the neighbouring kingdom. In the one case, the most essential trappings of a proud popish prelacy were left uncurtailed, nor was the church sufficiently purified from popish devices and observances.[1] The sign of the cross in baptism, with the entire apparatus of godfathers and godmothers, some part of the funeral service, kneeling at the communion, the power of the priest to remit or to retain sins, and the power of the bishop to confer the gift of the Holy Ghost, ought to have been left in the sole and undisputed possession of those who still adhere to the mass and transubstantiation. Queen Elizabeth, the head of the church, was deeply tinctured with popery; insomuch that she was dissatisfied with the twenty-ninth article, as implying a denial of the doctrine of the real presence. She reluctantly permitted the crucifix and tapers to be removed from the altar in her chapel. It seems to have been by her private authority that a clause, unsanctioned by the convocation, was added to the twentieth article;[2] a clause which makes the averment that " the church hath power to decree rites

[1] The genuine high-churchmen seem to feel some lingering regret for the discontinuance of the popish prayers for the dead. " In truth," says Mr Waddington, " to pray for the souls of our departed friends is the most natural and pardonable error of piety; and although it be dangerous and improper to inculcate as a church doctrine the efficacy of such prayers, it would neither be right to discourage their private and individual effusion, nor easy to disprove the possibility of their acceptance." (Present Condition and Prospects of the Greek or Oriental Church, p. 37. Lond. 1829, 8vo.) " Some persons," remarks Mr Palmer, " will perhaps say that this sort of prayer is unscriptural; that it infers either the Romish doctrine of purgatory, or something else which is contrary to the revealed will of God, or the nature of things. But when we reflect that the great divines of the English church have not taken this ground, and that the church of England herself has never formally condemned prayers for the dead, but only omitted them in her liturgy, we may perhaps think that there are some other reasons to justify that omission." (*Origines Liturgicæ*, or Antiquities of the English Ritual, vol. ii. p. 94. Oxford, 1832, 2 vols. 8vo.) This work, which is learned and curious in its way, might with a considerable degree of propriety have been entitled " The Conformity of the Church of England with the Church of Rome." Among other important facts, he is pleased to state that " the bishops who rule the churches of these realms were validly ordained by others, who by means of an unbroken spiritual descent of ordinations derived their mission from the apostles, and from our Lord. This continual descent is evident to any one who chooses to investigate it. Let him read the catalogues of our bishops ascending up to the most remote period. Our ordinations descend in a direct unbroken line from Peter and Paul, the apostles of the circumcision and the Gentiles. These great apostles successively ordained Linus, Cletus, and Clement, bishops of Rome; and the apostolical line of succession was regularly continued from them to Celestine, Gregory, and Vitalianus, who ordained Patrick bishop for the Irish, and Augustine and Theodore for the English. And from those times an uninterrupted series of valid ordinations have carried down the apostolical succession in our churches, even to the present day. There is not a bishop, priest, or deacon amongst us, who cannot, if he pleases, trace his own spiritual descent from Saint Peter and Saint Paul." (Vol. ii. p. 249.) To this last assertion it is only necessary to oppose another; namely, that there is not a single bishop, priest, or deacon, who can trace his own spiritual origin for one half of the requisite period. But what advantage could possibly result from their tracing it with the utmost certainty? Till they make an unequivocal display of their miraculous powers, we must totally disregard their extraordinary pretensions. By arguments equally logical and cogent, the bishop of Rome undertakes to prove that he inherits all the spiritual gifts and graces of St. Peter, and to these is fully entitled to add all the temporal power and possessions to which he can extend his impious hand. This delirious dream of apostolical succession is disgraceful to the protestant name; and all those whom it bewilders would best maintain their consistency by returning to the bosom of their mother chruch.

[2] See Archdeacon Blackburne's Confessional, p. 368, and Dr Lamb's Historical Account of the thirty-nine Articles, p. 33. Cambridge, 1829, 4to.

 or ceremonies, and authority in controversies of faith." The king or queen superseded the pope as head of the church; and thus a protestant body might have, and in more instances than one has actually had, a popish head. Pluralities and non-residence, two manifest remnants of popery, have been closely interwoven with an establishment, in which the idle splendour of one class of ecclesiastics is placed in so indecent a contrast with the laborious poverty of another.[1]

At this period, the metropolis of Scotland contained only one parish church. Knox was at first assisted by a reader, named John Cairns. It was then his regular practice to preach twice every Sunday, and thrice on other days of the week; but in the year 1563, John Craig, minister of Canongate, was appointed his colleague. In 1562, he had for three successive days been engaged at Maybole in a public disputation with Quintin Kennedy, abbot of Crossragwell; and in the course of the following year, an account of it was printed at Edinburgh, under this title: "Heir followeth the coppie of the Ressoning which was betuix the Abbote of Crosraguell and John Knox." Another learned catholic, Ninian Winzet, addressed to him a "Buke of fourscoir thre Questionis," to which it was his intention to publish an answer, though he seems to have been prevented by his other avocations, which were sufficiently numerous. After this period he incurred the hot indignation of the queen for having, in one of his public discourses, animadverted with great freedom on her intended marriage. During one of their interviews, she wept bitter tears of anger; and some modern historians have been not a little scandalized at his want of gallantry. In the month of December 1563, he was summoned before the privy council on a charge of high treason, for having written a circular letter to the protestant gentlemen, in reference to the trial of two persons who had been indicted for a riot in the chapel royal. Of this charge he was fully acquitted, to the great disappointment of Mary and the popish party.

After having continued a widower for more than three years, he married Margaret Stewart, daughter of the good Lord Ochiltree. This marriage took place in March 1564, when he had attained the age of fifty-nine. The noble family with which he thus became connected was descended from Robert duke of Albany, second son of King Robert the Second. Knox was again brought before the privy council, for having, in a sermon preached in St Giles's on the 19th of August 1565, used certain expressions, or rather quoted certain texts, which gave great offence to the king, who was present, and applied them to himself. He was for a short time prohibited from preaching. Early in the following year, Mary subscribed the catholic league for the extirpation of the protestants; and if she had not been controlled by several prudential considerations, she seemed sufficiently prepared to adopt extreme measures. When she returned from Dunbar, soon after the death of Rizzio, he retired from Edinburgh, and sought refuge in Kyle; nor does he appear to have resumed his pastoral care till after the final overthrow of her authority. Towards the close of the year he prepared to visit England, where his two sons were residing with some of their mother's relations for the purpose of receiving their education. He appears to have returned home soon after the queen had plunged herself into ruin by her marriage with Bothwell. He was a member of the general assembly convened at Edinburgh on the 25th of June 1567; and he preached a sermon at the coronation of the young king, which took place at Stirling on the 29th of the ensuing month. The assassination of the regent Moray, and the civil troubles which ensued, depressed his mind and affected his health: in October 1570 he felt a stroke of apoplexy, which however was of so mitigated a kind that he was able to appear in the pulpit; but his strength was greatly impaired by his unceasing exertions, and he never recovered any considerable degree of vigour. Before the end of that year, the freedom of his animadversions in the pulpit gave such deep offence to Kircaldy, governor of the castle, that at length he found it expedient to change his habitation. He quitted the metropolis on the 5th of May 1571, and retired to St Andrews, the scene of his early labours. Here in the following year he published "An Answer to a Letter of a Jesuit named Tyric." In a state of great debility he returned to Edinburgh towards the end of August 1572; and on the 24th of November he closed his most laborious and most honourable career, after having attained the age of sixty-seven. He left two sons by the first, and three daughters by the second marriage. Both his sons studied at St John's College, Cambridge, and both of them became fellows. Nathaniel, the elder of the two, took the degree of A. M., and died in the year 1580. Eleazer, the younger son, proceeded B. D., and was one of the preachers of the university. Having been collated to the vicarage of Clacton-Magna, he died in 1591, and was buried in the college chapel. The three daughters, named Martha, Margaret, and Elizabeth, were married to three clergymen, James Fleming, Zachary Pont, and John Welsh. The widow of Knox became the wife of Sir Andrew Ker of Fadounside, who is described as a strenuous supporter of the reformation.

The vigorous and ardent mind of Knox was lodged in a diminutive and feeble body, which had been wasted by various hardships, and by intense mental exertion. His natural talents were improved by no mean attainments of learning, and he was eminently distinguished by an impetuous and impressive eloquence, which gave him a great ascendency among his countrymen. That he was a man of fervent and habitual piety, will not be disputed by any one whose prejudices do not prevent him from forming a correct estimate of his character. From an early period of his life, he devoted his entire energies to the best of all causes; and, in the hand of Providence, he was the great instrument which rescued his countrymen from the fangs of papal tyranny and superstition; nor is any other name entitled to be mentioned with equal honour in the annals of Scottish history. Of civil as well as ecclesiastical tyranny he was a decided enemy; and his writings contain some bold speculations on the subject of government. No man was more upright in his intentions, or more disinterested in his motives. That the impetuosity of his character occasionally impelled him beyond the bounds of moderation may be fully admitted without any diminution of the re-

[1] Bishop Lowth has stated that "there were some in England who, by the pope's authority, possessed at once twenty ecclesiastical benefices and dignities, with dispensation moreover for holding as many more as they could lawfully procure, without limitation of number." (Life of William of Wykeham, Bishop of Winchester, p. 28, 3d edit. Oxford, 1777, 8vo.) In what protestant country, except England and Ireland, is the system of pluralities and non-residence maintained to any extent? They are an intolerable nuisance, which even there must very speedily be abated. Even the regius professor of divinity at Oxford is convinced that there is a great and general "demand for church reform;" and as Dr Burton is a man of sense as well as learning, he must likewise be aware that, when there is a great and general demand for any commodity, it can in most cases be supplied. His notions of reform, as the reader may easily conjecture, are not extravagant; and some of his suggestions are not deficient in worldly wisdom. It is notorious, as he avers, that many clergymen enjoy the income of their benefices, because the presentations have been bought and sold; and "if any legislative enactment should reduce their incomes, the patrons must in all fairness refund part of the purchase money." (Thoughts upon the Demand for Church Reform, p. 38. Oxford, 1831, 8vo.) All the lay-dealers in such articles must therefore perceive the dangerous tendency of a reform in the church.

spect due to his name: he was placed in a situation which required great energy and decision; and a person chiefly distinguished by the gentler virtues, would have been very indifferently prepared to encounter the boisterous elements with which he was destined to contend. It is not to be concealed that he was not exempted from that spirit of intolerance which, in a greater or less degree, belonged at that period to every sect and denomination of Christians. He was as little disposed to tolerate the mass as the mass-priests were to tolerate those whom they termed heretics. The principles of mutual toleration were little understood or relished; and almost every one who possessed the power betrayed the inclination of imposing, by very ungentle means, his own creed upon his neighbours.

Beside the works which have already been mentioned, he composed various others, which are accurately enumerated by his biographer. "His practical treatises," says Dr M'Crie, "are among the least known, but most valuable, of his writings. In depth of religious feeling, and in power of utterance, they are superior to any works of the same kind which appeared in that age. The thoughts are often original, and always expressed in a style of originality, possessing great dignity and strength, without affectation or extravagance." The work by which he is best known as an author is "The Historie of the Reformatioun of Religioun within the Realm of Scotland." So early as the year 1586, an octavo edition of it, to the extent of twelve hundred copies, was undertaken in England by Vautrollier, a well-known printer; but when ready, or nearly ready for publication, it was seized by the command of Archbishop Whitgift. Some imperfect copies, all of them wanting the beginning and the end, have however survived this visitation of the protestant inquisitor. An edition was afterwards published by David Buchanan, who has taken very unwarrantable liberties with the text. Lond. 1644, fol. Edinb. 1644, 4to. He has suppressed various passages, and interpolated others; and the fifth book, which has not been found in any manuscript, is perhaps his sole composition. A genuine edition, "taken from the original manuscript in the university library of Glasgow," was at length published by Matthew Crawford, professor of ecclesiastical history in the university of Edinburgh. Edinb. 1732, fol. A collective edition of his works, executed with fidelity and elegance, might be preferable to any monument of bronze or marble that could be erected to the memory of this great benefactor of his native country. (x.)

KNUTSFORD, a town of the county of Chester, in the hundred of Bucklow, 173 miles from London. It stands on the river Birken, is the place where the sessions for the county are held, and has a well-attended market on Saturday. The principal employment is in the cotton manufacture. It is an ancient town, said to have been in existence in the time of the Danish king Canute, who gained a victory, and gave its name, Canute's Ford, to the place where his army passed. The inhabitants amounted in 1801 to 2052, in 1811 to 2114, in 1821 to 2753, and in 1831 to 2823.

KODIAK, an island on the west coast of North America, about fifty miles from the entrance into Cook's Inlet. It is about sixty miles in length, and, along with the smaller island of Atognak, is separated from the continent by the Straits of Cheligoff. The natives are robust, active, and well skilled in all the arts connected with fishery. They have an ingenious manner of constructing their boats, which are almost entirely covered with leather. The port of St Paul's on this island was long the chief seat of the trade of the Russians with north-western America. The natives having been found extremely serviceable, were removed in great numbers to the other Russian settlements along the coast.

KOEI-TCHOO, a province of China, situated near the south-western extremity of the empire, bordering on Yunan. It is of a much more unequal surface than the rest of the empire, and full of precipitous mountains, inhabited by barbarous and independent races, from whom the Chinese emperor is scarcely able to collect the moderate tribute which he exacts, even by the aid of all the forts and garrisons which he is obliged to maintain. The mountains yield gold, silver, copper, and mercury. Sir George Staunton estimates the population at 9,000,000.

KOEI-TCHOO-FOU, a city of China, of the first rank, in the province of Setchuen. It is situated on the great river Yang-tse-kiang, and has a very extensive trade. The neighbouring country is mountainous, but is highly cultivated, and abounds in fruit. Long. 109. 50. E. Lat. 31. 9. N.

KŒMPFER, ENGELBERT, was born in 1651 at Lemgow, in Westphalia. After studying in several towns, he went to Dantzig, where he gave the first public specimen of his proficiency, in a dissertation *De Majestatis Divisione.* He then went to Thorn, and thence proceeded to the university of Cracow, where he took his degree of doctor in philosophy; after which he went to Königsberg in Prussia, and staid there four years. He next travelled into Sweden, where he soon began to make a figure, and was appointed secretary of the embassy to the sophi of Persia. He set out from Stockholm with the presents for that emperor, and went through Aaland, Finland, and Ingermanland, to Narva, where he met Mr Fabricius the ambassador, who had been ordered to take Moscow in his way. The ambassador having ended his negotiations at the Russian court, set out for Persia. During their stay two years at Ispahan, Dr Kœmpfer, whose curious and inquisitive disposition suffered nothing to escape him unobserved, took all the advantage possible of remaining so long in the capital of the Persian empire. When, towards the close of 1685, the ambassador prepared to return into Europe, Dr Kœmpfer chose rather to enter into the service of the Dutch East India Company, in quality of chief surgeon to the fleet, then cruising in the Persian Gulf. He went on board the fleet, which, after touching at many Dutch settlements, reached Batavia in September 1689. Dr Kœmpfer here applied himself chiefly to natural history. From Batavia he set out for Japan, in quality of physician to the embassy which the Dutch East India Company send once a year to the Japanese court. He quitted Japan to return to Europe in 1692. In 1694 he took his degree of doctor of physic at Leyden; on which occasion he communicated, in what are called *Inaugural Theses,* ten very singular and curious observations made by him in foreign countries. He intended to digest his memoirs into proper order, but was prevented by being made physician to the Count la Lippe. He died in 1716. His principal works are, 1. *Amœnitates Exoticæ,* in 4to, a work including many curious and useful particulars in relation to the civil and natural history of the countries through which he passed; 2. *Herbarium Ultra-Gangeticum;* 3. The History of Japan, in German, for which the public is indebted to Sir Hans Sloane, who purchased for a considerable sum of money all our author's curiosities, both natural and artificial, as likewise all his drawings and manuscript memoirs, and prevailed on Dr Scheuchzer to translate the Japanese history into English.

KOHCRAAN, a district of Hindustan, in the north-western quarter of the province of Lahore, situated between the thirty-third and thirty-fourth degrees of north latitude, on the western side of the Jhylum or Hydaspes River. It contains no town of note, and the face of the country is extremely hilly and wild, possessed by petty chiefs, who are tributary either to the Sciks or Afghans.

KOKAUN, an independent state of Asia, which is separated from Buckharia on the east by steep and inaccessible mountains; on the south it has the mountainous tract which divides it from Buduckshang and Chitral; on the south-west it is confined by Kurratageen; on the east and north-east by the mountains inhabited by Kirgeesh and Kuzaks, tributary to China; on the north-west by the district of Tashkund, lately reduced under its authority, with mountains and deserts. This kingdom is divided into thirteen districts, all of which contain towns more or less considerable. The river Sihoon or Jaxartes, which takes its rise about four days' journey south-east of Kokaun, divides the country into two parts. The territory of Kokaun is 200 miles in length by about 150 miles in breadth. The general description of the country is mountainous, divided by valleys and plains, of which those near the river Sihoon and its tributary streams are rich and fertile, and those more removed comparatively arid and sterile. Many villages, and a good deal of cultivated ground, are scattered over its surface; and many places afford rich pasture for the flocks and herds of the tribes who wander over it. The inhabitants are chiefly Uzbecks, who are shepherds, and a few Tanjeks, who live in villages, and are described by Fraser[1] as a stout, fat, fair, and high complexioned people, extremely quiet, good humoured, merry, and hospitable. They are fond of active pursuits, such as riding, hunting, hawking, and are more addicted to intemperance. There are many other wandering tribes in Kirgeesh, &c. scattered over the face of the country. The winter is severe, though there is but little snow. The summer is very hot and parching, and there is not much rain till towards the end of autumn. They produce a great deal of silk in the country, which is manufactured into various fabrics. Mulberry trees are planted round all the fields, and cotton is also much cultivated. Willows, poplars, cypresses, with all kinds of fruits known in Europe, are common here. Sycamores are rare, but the hills are covered with lofty pines, poplars, almond, walnut, and pistachio trees. The name of the capital is Kokaun, which was formerly a petty village; but, by becoming the seat of government, it has increased so much that it now contains more than 50,000 houses. It has no wall, and water has been introduced into most of the streets from the river Jaxartes, upon the bank of which it is situated. The women of the towns and villages are concealed, like those in other Mahommedan states, and wear veils from head to foot. A journey was undertaken in 1813 by M. Nazaroff, a Russian, who travelled with the tracking caravans, and, crossing the deserts, penetrated as far as Kokaun or Khokand, where he was exposed to danger from the jealousy of the chiefs, and the fanatical hatred of the people. He was at last permitted to return to his own country.

KOLIN, a city of the circle of Kaurzim, in the Austrian kingdom of Bohemia. It is on the banks of the Elbe, contains 416 houses, and 4387 inhabitants, who are employed in cotton weaving, and in iron manufactures. Near to it is the field of battle where, in 1757, Daun defeated Frederick of Prussia.

KOLLBERG, a city of Prussia, in the province of Pomerania, and the circle of Koslin. It is on the river Persante, about one mile from its entrance into the Baltic. It has some foreign trade, and considerable establishments for building ships; and near to it are some extensive salt-works, belonging to the crown. It contains four churches, 780 houses, and 7950 civil inhabitants, besides a garrison. It is chiefly remarkable for the strength of its position, and for its fortifications. It stands on a hill surrounded with morasses; and the broad ditches can be with ease filled with water from the river Persante. A strong citadel commands the city and the entrance from the sea, and it has several strong out-works.

From its importance as a landing-place, it has been frequently attacked. The Russians besieged it in 1758, but were repulsed. In 1760, it was attacked by a combined fleet of Russian and Swedish ships and 15,000 land troops, but it was relieved by General Werner. Again, in the next year, it was attacked by the Russian general Romanzoff, with fifty-five ships of war and a powerful land force. It was ably defended during four months, and the Russians lost more than 3000 men in the trenches; but at length, from want of provisions, it capitulated on the 16th December.

The most distinguished defence was that in 1807, when most of the other strong places in Prussia had surrendered to the invading armies of Bonaparte. It was attacked by 18,000 men, commanded by Loisson, and defended by 6000 Prussians, including volunteer inhabitants. After a siege with constant bombarding, in which the greater part of the city was destroyed, it surrendered, having lost 1900 men. General Gniseneau, who commanded on this occasion, first displayed his high military talents. Long. 15. 32. N. Lat. 54. 7. E.

KOLOMEA, a circle of the Austrian kingdom of Galicia, extending over 1263 square miles, and comprehending three cities, twelve market-towns, and 204 villages, containing 30,618 houses, with 156,614 inhabitants, of whom 11,700 are Jews. It is an agricultural district, yielding corn and flax in the level parts; but a large portion of it is mountainous and barren. The capital is the city of the same name situated on the river Pruth, with a Greek and a Catholic church, and 1890 inhabitants.

KOLUMNA, a circle in the Russian province of Moskwa, which extends over 662 square miles, comprehending one city and 269 parishes, with 65,650 inhabitants. The capital is the city of that name, on the river Kolomenka, which runs to the Moskwa. It contains a cathedral and sixteen other churches, with 1150 houses, mostly of wood, and 6340 inhabitants. There is much tallow and leather produced, and there are manufactures of linen, silk, and cotton goods. Long. 38. 25. E. Lat. 55. 20. N.

KOLYVAN, a province of Asiatic Russia, in the government of Tomsk, situated on the upper course of the Obi. It is chiefly distinguished by the abundant copper mines within its limits, containing a considerable proportion both of silver and gold. These mines were discovered in 1727 by M. Demidoff, who, when he began to work them in 1730, publicly extracted the copper, but was obliged clandestinely to separate the gold. This fraud being discovered by a German, the mines were confiscated to the use of the government; and, according to the accounts of the board of mines, these works, from 1725 to 1786, produced about 3,500,000 pounds of silver, and 48,000 pounds of gold. The town of Kolyvan is small, situated on the right bank of the Berda, near its junction with the Obi. Long. 81. 50. E. Lat. 54. 48. N.

KOMORN, a circle of the province of the Farther Danube, in the Austrian kingdom of Hungary. It extends over 1167 square miles, comprehending one city, five market-towns, and 156 villages and hamlets, with 12,256 houses. The inhabitants are two-thirds Catholics, and one-third reformed Protestants. The capital is a city of the same name, at the junction of the Waag with the Danube. It is strongly fortified, and has five Catholic, one Lutheran, one Reformed, and one Greek church, with 1400 houses, and 11,200 inhabitants. A great part of the city was thrown down by an earthquake in 1763, and again by another in 1783, but the damages were speedily

[1] *Narrative of a Journey into Khorassan*, Appendix, p. 108.

repaired. There are manufactures of woollen cloth, several tanneries, and the fishery on the Danube gives employment to many persons. There is a strong fort on the point of land where the two rivers meet. Long. 18. 2. 30. E. Lat. 47. 45. 34. N.

KONG, a kingdom of Central Africa, to the south of the Niger, nearly midway between Ashantee and Bambarra. According to Park, *kong* signifies mountain; and the physical aspect of the country corresponds to this, being traversed by a great central chain of mountains bearing the same name. There is little known concerning this kingdom; and it appears to be by no means so wealthy and powerful as that of Ashantee, although the country is populous, and abounds in horses and elephants.

KONG-CHANG-FOU, a city of China, of the first rank, in the province of Shensi, near the western frontier. The surrounding country is mountainous, and abounds with the animal which produces musk. It is situated near the head of the river Hoeiho, which falls into Yellow River, and is the seat of an extensive trade. Long. 104. 19. E. Lat. 34. 56. N.

KONGSBURG, a city of Norway, in the province of Aggerhuus. It is situated on the Lovenelf, in a deep and wild valley, which the mountain Jons Knuber, 2800 feet high, overlooks. It contains 1500 houses, and 6800 inhabitants. It was formerly the head of a mining department, and near it the silver mines were extensively worked for several ages, till, in the present century, it was found that the expense exceeded the value of the gross proceeds, and the works were abandoned. The establishment of the cotton manufacture now gives employment to the population, who would be otherwise in a most destitute condition.

KONIG, George Matthias, a learned German, born at Altorf, in Franconia, in 1616. He became professor of poetry and of the Greek tongue there, and librarian to the university; in which last office he succeeded his father. He gave several public specimens of his learning, but is principally known for a biographical dictionary, entitled *Bibliotheca Vetus et Nova*, 4to, Altorf, 1674; which, though it is very defective, is still useful to biographers. He died in 1699.

KONIGBERG, a city of the circle of Barsch or Bars, in the Austrian kingdom of Hungary, on the river Gran. It is in a deep valley, surrounded by three mountains. It contains 510 houses, and 3770 inhabitants. There were formerly mines of gold and silver, but these have ceased for several years to be worked. Long. 18. 32. 35. E. Lat. 42. 25. 42. N.

KONIGINGRATZ, a circle of the Austrian kingdom of Bohemia, extending over 1536 square miles. It contains forty-two cities and towns, and 810 villages and hamlets, with 48,259 houses, and 271,080 inhabitants. It is moderately fertile, and produces corn, flax, wood, and has good pasturage. The capital is a city of the same name, on the river Elbe, well fortified. It contains, besides the cathedral, six churches, two hospitals, and an orphan-house, with 624 dwellings, and 5903 inhabitants, employed chiefly in making woollen cloths. Lat. 50. 12. 38. N.

KONIGSBERG, a city of Prussia, on the river Rorikê, in the circle of that name, and in the Frankfort division of the province of Brandenburg. It is walled, and contains 458 houses, with 4178 inhabitants, employed in making cloth and hosiery, and in distilleries and breweries.

Königsberg. In the recent division that has been made of those parts of the dominion of Prussia that are out of Germany, East Prussia has been formed into two governments, viz. Königsberg and Gumbinnen. The former of these is composed of the territory formerly called East Prussia, and a small part of Lithuania. It is bounded on the north by Russia, on the east by the province of Gumbinnen, on the south by Poland, and on the west by the Baltic Sea and the province of Dantzic. Its extent is 8910 square miles. It contains forty-eight cities or places formerly walled, thirteen market-towns, 3717 villages, and 76,949 houses. The inhabitants in 1826 were 683,925, of whom about 450,000 were Protestants, 110 Catholics, and the rest consisted of Jews, Moravians, and Menonites. It is generally a level country, presenting few elevations, and these scarcely higher than 200 feet above the level of the sea. It is a district in which are to be seen numerous lakes, some of great extent. The largest of these, the Kurische-Haff, extends over 620 square miles; and the next in size, the Frische-Haff, is upwards of 500 miles. Besides these, there are others of various extent, amounting in number to near five hundred. The soil is generally sandy, but moderately productive, and yields good crops of rye and barley, and a small proportion of wheat. Its breeds of sheep and cows have nothing remarkable, either for their number or their qualities; but this province has been the repository from which the best and most numerous horses have been reared of the whole monarchy.

The country is tolerably fertile; and from some of the districts of Polish Russia much corn is brought down by the navigable rivers. The export of corn is, therefore, one of the chief branches of commerce, and has been as follows:—

An Account showing the Corn exported from Kōnigsberg in each Year from 1818 *to* 1831.

Years.	Wheat. Quarters.	Rye. Quarters.	Barley. Quarters.	Oats. Quarters.	Pease. Quarters.	Beans. Quarters.	Tares. Quarters.	Hemp and Flax Seed. Quarters.
1818	31,290	84,290	44,250	38,590	29,530	...	...	...
1819	12,320	73,600	29,520	15,130	19,910	1,360	...	18,230
1820	28,610	67,690	8,180	55,650	12,100	410	4,390	24,970
1821	15,590	14,590	2,150	8,640	2,334	...	4,880	18,640
1822	5,910	1,010	2,920	2,000	2,080	...	780	31,730
1823	4,280	10,300	240	1,160	2,150	...	...	3,200
1824	10,020	3,930	2,980	15,660	4,120	...	220	12,570
1825	8,160	6,570	15,310	5,930	7,120	...	9,260	10,160
1826	14,830	6,920	2,010	53,210	8,030	...	7,160	22,710
1827	37,540	72,280	23,320	81,800	5,030	980	9,290	27,280
1828	95,430	129,200	13,460	13,680	9,190	560	5,160	28,840
1829	76,980	81,540	22,720	36,600	4,220	1,070	2,070	37,180
1830	75,050	250,120	16,870	83,100	23,600	1,300	1,410	38,730
1831	75,650	160,900	9,880	40,920	15,060	990	3,260	18,840

The other exports in one year (1831) were as follow :— Bristles, 167,997 pounds; feathers, 13,860 pounds; flax, 75,230 stones; hemp, 60,276 stones; hides and skins, 53,707 pounds; wax, 31,955 pounds; wool, 118,068 pounds; linen yarn, 9000 bundles. The remaining exportable commodities are chiefly the produce of the extensive forests, consisting of ship-timber, pot-ash, and tar. These are chiefly shipped at Memel, but some at the capital. Some portions of flax and of flax-seed are also exported. The manufactures of the province are merely of a domestic nature, and very inconsiderable.

Konigsberg, the capital of the province, is a city standing on the navigable river Pregel, which empties itself into the Frische-Haff, about five miles below it. With the exception of Berlin, it is the largest city in the Prussian dominions, and was formerly the capital. It is surrounded with walls defended by thirty-two ravelins, contains a royal palace, eleven Lutheran, two Reformed, one Catholic, and one Menonite church, amongst which the domkirch or cathedral is remarkable as containing the remains of the most distinguished individuals. It has several establishments for benevolent purposes, especially the great royal hospital, with nearly 1000 patients. The houses are 4503, and the inhabitants, including troops, 63,240, of whom more than 1500 are Jews. Königsberg is the seat of an ancient and celebrated university, containing twenty-two professors, having a botanic garden, an astronomical observatory, and the other establishments for the education of students in medicine, law, theology, and philosophy. It has, besides, institutions for the earlier stages of education. The trade is considerable, notwithstanding the shallowness of the river renders it necessary to load and unload ships by the aid of lighters. The manufactures are only for the consumption of the province. Long. 20. 25. 1. E. Lat. 54. 42. 12. N.

KONIGSLUTTER, a city of the duchy of Brunswick, in Germany, the capital of a circle of the same name. It is on the river Lutter, is walled, and contains a palace of the prince, two churches, in one of which the minster is an ancient monument to the memory of the Emperor Lothario the Second and his empress. It contains 338 houses, and 2850 inhabitants, who carry on several extensive distilleries, and make linen and other cloths.

KONIGSTEIN, a small city of the kingdom of Saxony, in the bailiwick of Pirna and province of Meissen, situated on the left bank of the Elbe, and containing 190 houses, with 1450 inhabitants. It is in that part of the kingdom commonly called Saxon Switzerland, and is remarkable for the impregnable fortress adjoining to it. The mountain castle overlooks the town, on a rock whose perpendicular face towards the Elbe is about 900 feet. It includes, on the top of the rock, within its walls, fields, gardens, meadows, and a wood, and a well abounding with water, 900 feet deep, so that sufficient provision for the garrison can be grown within itself; but there are large storehouses on the rock, for provisions, ammunition, and all necessaries; amongst others, two great casks of wine, capable of containing 1000 hogsheads. The casernes are bomb-proof, and, from the nature of the rock, the castle can neither be assailed by traverses nor by mines. In this fortress, the jewels, money, curiosities, and archives of the crown have been deposited in time of war, and were secure when the capital and its palaces were occupied by Frederick of Prussia, as well as at a more recent period, when Dresden was the head-quarters of the French army, and assailed by the allied forces of Russia, Austria, Prussia, and Sweden. The castle contains also the state-prison. On the opposite side of the Elbe is the fortress of Lillienstein, on a sandy rock 1080 feet above the river. It is now dilapidated, but was occupied by the French in 1813, who added to the works.

KONJEUR, a small district of Hindostan, in the province of Orissa, situated principally between the twenty-first and twenty-second degrees of north latitude. It is bounded on the north by the districts of Singboom and Mohurbunge, and to the south by the province of Cuttack. It was formerly tributary to the Mahrattas, but is now occupied by independent chiefs. It is fertilized by many streams, but is now in a neglected state. The principal towns are Konjeur, Ogurapoor, and Andapoorgur.

KONKODOO, one of the three independent states into which Bambouk, a considerable territory of Western Africa, is divided. Latadoo and Bambouk are the names of the two other kingdoms, the latter having given its name to the whole territory. The country is crowded with steep mountains, composed of a species of red granite, but they are clothed with vegetation to the very summits; and the villages, which are built in delightful glens, present a most romantic appearance. Gold is distributed in larger or smaller quantities throughout Konkodoo, and the chief occupation of the inhabitants seems to be the collecting of the precious metal, which they separate from grosser matter by mechanical processes. This kingdom is governed by a chief; but the Siratik, the regal title of the sovereign of Bambouk, enjoys an honorary superiority.

KOOKIES, a singular race of people, who inhabit the mountains to the north-east of the Chittagong district, in the province of Bengal. They are little known to the inhabitants of the plain, and are seldom seen except when they visit the markets on the borders of the jungles in the Rungancah and Aurungabad divisions, to purchase salt, dried fish, and tobacco. The Kookies are a stout, muscular race, but not tall, and have the peculiar Tartar features of the Asiatics in the east, namely, the flat nose, small eye, and broad, round face. They are divided into a number of distinct communities independent of each other, and are all hunters and warriors. Their arms are bows and arrows, clubs and spears; and, by way of defence, they build their villages, which generally contain from 500 to 2000 inhabitants, on the most inaccessible hills. They are much addicted to war, in which they are almost constantly engaged; and, like most savages, they prefer ambuscades and surprises to regular battle. They are vindictive in their dispositions, and always shed blood on a principle of retaliation. They use an intoxicating liquor distilled from rice, which they drink at marriages, these being attended with much feasting. They have an idea of rewards and punishments in a future state, and they have also a saint or angel which they worship as the mediator between them and the Deity. They have no regular priests, and the master of each family instructs the children in the religious knowledge which he thinks necessary. They sometimes engage in war with the Choomeas; but being in great dread of fire-arms, they are quickly driven back to their native mountains. They are, however, a great terror to the inhabitants on the borders of the Chittagong district, especially to the wood-cutters, on whom they frequently make inroads. They subsist partly by the chase; and they have no religious prejudice against any animal. An elephant is considered as a great prize by them, as it affords so great a quantity of food. Their domestic animals are gagals, goats, hogs, dogs, and fowls.

KOOM, a city of Persia, in the province of Koom. It stands on an extensive plain, and on the banks of a small river, which rises at no great distance, and is lost in the great Salt Desert. This city was built by the Saracens in the year 806, upon the site, as D'Anville supposes, of the ancient Choana. It was erected from the ruins of seven towns, which had composed a small sovereignty under an Arabian prince. It afterwards became one of the finest cities of Persia, and was long celebrated for the manufacture of silks. It was taken by the Afghans in 1722, when they invaded Persia, and completely destroyed it. Part of it has since been rebuilt, but it has still the appearance of a vast ruin. There is a very beautiful college, with a celebrated mosque and sanctuary erected to the memory of Fatima, the daughter of Imaun Reza. In the mosque are still to be seen the tombs of Sofi the First and Shah Abbas the Second. The dome is lofty, and has been gilded at the expense of the king. About ten miles to the north of the town is a very curious hill in the middle of the plain, called by some Nimick Koh, or the mountain of salt, and by others Koh Talism, the mountain of the talisman; for, according to the tradition of the country, no person ever succeeded in gaining its summit. Long. 50. 29. E. Lat. 34. 45. N.

KOONTASSEE, a small town of Hindustan, in the province of Gujerat and district of Morvee, near the great marshes called the Runn. The country in the neighbourhood is in a deplorable state, and the villages nearly uninhabited, owing to the tumult and confusion which pervade the whole district.

KOORBAH, a town of Hindustan, province of Gundwana, district of Choteesgur, thirty-six miles north-east from Ruttunpoor. Long. 83. 8. E. Lat. 22. 25. N.

KOOTAHE, or COCOA ISLAND, in the South Pacific Ocean, and separated from Neootabootaboo by a channel only three miles broad. It was discovered by Schouten and Le Maire, on the 10th May 1616. Long. 173. 48. W. Lat. 15. 55. S.

KOPAUL, a town of Hindustan, belonging to the nizam, in the province of Bejapoor, and district of Gujundergur. It is one of the strongest places in the south of India. The lower fort is a semicircle at the bottom of a steep, rocky mountain, commanded by a middle and upper fort, the last overlooking the whole. It is chiefly formed of one immense rock, almost perpendicular, and of great height. In 1790, when it was possessed by Tippoo, it was besieged by the nizam's army, and capitulated after a siege of six months. It is 63 miles north-west from Bellary. Long. 76. 6. E. Lat. 15. 28. N.

KOORANKOO, a considerable kingdom of Western Africa. It is bounded on the west by the Bullom, Limba, and Timmanee countries; on the north by Limba, Tamisso, and Soolimana; on the east by Kissi, the Niger, and countries little known; and on the south by those countries which border on the coast. These limits include a very extensive tract of country, but the boundary lines are somewhat indefinite; indeed they are continually fluctuating, according to the fortunes of war as it is practised amongst savage tribes of men. For our knowledge of Koorankoo we are indebted to the enterprise of Major Laing, by whom is was visited and has been described. A chain of hills, sixty miles in length, runs in a north-easterly direction throughout the whole of the country. These are for the most part clothed at their base with the camwood tree, which constitutes the staple article of trade. The range is composed of micaceous granite and mica slate, interspersed with veins of quartz and laterite, so strongly impregnated with iron as sensibly to affect the needle at some inches distance. The principal rivers appear to be the Rokelle and the Kamaranka. The source of the former is set down in Major Laing's map as in latitude 9. 45. north, longitude 9. 55. west, a parallel which lies in the Soolima country. It issues from the foot of a hill, by barometrical measurement 1470 feet above the level of the Atlantic; and after receiving several tributaries, and traversing Koorankoo and other countries, falls into the sea at Sierra Leone, to which colony it is of great importance. The Rokelle is the only river, says Major Laing, which bears one name from the source to the sea. The rivulets and longer streams which discharge themselves into it are picturesquely beautiful, dashing over rugged granite rocks several hundred feet in elevation. One of the tributaries, called Ba-Jafana, had a bed of about fifteen yards in breadth, though only about three miles from its source, which is in a mountain named Balakonko, where the natives procure the camwood in great abundance. The banks of the river are likewise lined with this wood, which grows to the height of about sixty feet. The Tongolelle, a rapid stream about thirty yards broad, also joins the Rokelle. It takes its rise in a sort of basin, surrounded with thick brushwood, and gives birth to a rich and luxuriant growth of wild canes in its centre, affording a cool retreat to the leopards which infest this part of the country. To such an extent are these rapacious animals dreaded, that Major Laing "observed the sites of several towns now in ruin, the inhabitants of which had been forced to move to the westward to avoid their attacks." The Kamaranka appears to be a river of the same size and general character as the Rokelle. It has also numerous tributaries. All the rivulets running south through the mountain chain already mentioned collect behind a lofty hill called Botato, and fall into it. About a mile from Nyiniah, one of the largest and best-built towns in Koorankoo, is the source of a fine stream, which joins the Kamaranka. The spring forms a basin ten yards in diameter, embanked with masses of granite, and overhung with lofty trees, clad with a foliage so thick as to bid defiance to the rays even of a vertical sun. Major Laing describes the scenery in this quarter as occasionally very picturesque and beautiful. After crossing a range of hills to the eastward of Nyiniah, there presented itself to the eye of the traveller "an extensive valley, partly cultivated, and partly covered with long natural grass about five feet high, the cultivated part newly sown; lines of stately palm trees, as regular as if laid out by art, with here and there a cluster of camwood trees, their deep shade affording a relief to the lighter hue of the smaller herbage; these, with a murmuring rivulet meandering through the centre, exhibited the appearance of a well-cultivated and tastily-arranged garden, rather than a tract amid the wilds of Africa; whilst, in the distance, mountain towered above mountain in all the grandeur and magnificence of nature. There was also seen an extensive plain covered with short, thin grass; and our traveller having crossed a mountain ridge which separates the head streams of the Kamaranka, flowing southward, from those which reach the Rokelle, he ascended a lofty eminence called *Sa Wolle.* The summit of this mountain, according to barometrical measurement, was 1900 feet above the level of the sea, and the view from it was grand and extensive in the highest degree. A capacious circle of nearly two degrees in diameter, interrupted only by a hill to the eastward, which rose considerably higher, presented a landscape of the most rich and varied scenery.

Camwood is the staple article of trade, and it is sent down the Rokelle and the Kamaranka to be bartered for various articles, chiefly salt. There is also a considerable advantage derived from the extensive manufacture of cloth. The loom in which this is wove is very narrow. The artisan sits under an open shed, from the roof of which are suspended two frames of equal breadth with the roof, nicely divided with perpendicular strings. By a motion of the feet, these are made to cross one another alternately, and at each motion the shuttle is cast through. In this manner of working they exhibit much dexterity, and make good progress. Women are employed in spinning thread, but the sowing and weaving are performed by men.

Major Laing observes, "Koorankoo is the first country to the eastward of Sierra Leone where the manufacture of cloth is common; but it is generally of a coarse quality. As the traveller advances eastward, he finds the natives improve both in the texture of the cloth and the size of the loom. In Sangara, very large and handsome cloths are manufactured." The Koorankoos also cultivate a considerable portion of their ground; and in general intelligence and industry they rank above the neighbouring tribes. Each house has its enclosed garden, where are raised cassada, in the cultivation of which they bestow great care; spinach, small onions, and tankana, an herb which, when dried and beaten, answers as a cheap substitute for snuff. In religion they are for the most part pagans, and they exercise unlimited faith in *greegrees* (a sort of protecting spirits), for whom they have houses consecrated at the entrances of the towns. The head men are clothed in a long gown, trousers, cap, and sandals, but the women are contented with more scanty habiliments. They are great adepts in the art of dressing hair, and ornament each other's heads with great skill. Dancing is a favourite amusement; and on the night of a funeral, which always takes place the day after the demise of the individual, they exhibit their skill in this art, brandishing hatchets or spears in both hands. The laws of this people are few and inartificial. Murder is the only crime punishable with death, and even this can be compensated by property.

There is a portion of the Kooranko country inhabited by the tribe called the Soolimas. They have a territory of their own, which Major Laing describes as picturesque in the extreme, being diversified with hills, extensive vales, and fertile meadows, belted with stripes of wood, and decorated with clumps of trees of the densest foliage. The soil is remarkably fertile, producing chiefly rice, yams, which are planted like potatoes in England, and ground nuts, which are cultivated like our field peas. Bananas, pines, and oranges, are the principal fruits; but the first only are found in any degree of perfection. The Soolimas have numerous herds and flocks, and a diminutive kind of poultry. The elephant, the buffalo, a species of antelope, monkeys, leopards, and wolves, are the wild animals. The principal towns of the Soolimas are all situated in the Koorankoo country. These are Falaba, the capital; Sangonia, a very large town on the borders of Footah Jallou, surrounded with a strong and lofty wall; Semba, a large, populous, and rich town near the southern frontier, situated on a very lofty eminence; Mousaiah and Koonko-doogore, a stage from Semba, in the hills. In all, these places contain a population of about 25,000 souls. Falaba derives its name from the river Fala, on which it stands. It is nearly a mile and a half in length, by a mile in breadth, and closely built compared with the generality of African towns. It was built in 1768 by the Soolima king, as a stronghold to protect him against his enemies the Foolahs; and the site is well chosen as a place of defence, being on a gently-rising eminence in the centre of a large plain. The town is surrounded by a strong stockade of hard wood, and a deep and broad ditch, which renders it quite impregnable according to the military tactics of the Africans. It contains about four thousand circular clay huts, having pyramidal roofs of thatch; and, being neat and clean, they present a very respectable appearance. The palaver or court-house stands in an open space, towards the southern extremity of the town, and is a place of recreation as well as of business. In the centre of the town a large piece of ground is left vacant, for the purposes of exercise, of receiving strangers, and of holding palavers. Formerly the Soolimas chiefly occupied themselves in war, but this is less practised amongst them now than heretofore. In person they are short and muscular, and well adapted to endure privation and fatigue. Their military weapons are the spear, the musket, the sling, and the bow: in the management and use of the two latter they are most expert. Where their predatory habits do not interfere, they seemed to Major Laing both mild and inoffensive in disposition. In their domestic occupations the men and women appear to have changed places. The men attend to the dairy; they also sow and reap; but all the other cares of husbandry devolve upon the female sex. They are masons, plasterers, surgeons, and the like; whilst the men employ themselves in sewing, and not unfrequently in washing clothes. In religion, government, dress, customs, and the like, the Soolimas resemble the Koorankoos, so that these do not require a separate description.

KOPYS, a town of the province Mohilew, in Russia, the capital of a circle of the same name, on the river Dnieper. It contains a Greek, Catholic, a Lutheran, and a Unitarian church, with 3800 inhabitants. Long. 30. 10. E. Lat. 54. 20. N.

KORAH, a district of Hindustan, in the province of Allahabad, situated in the doab, or the space enclosed between the Ganges and the Jumna, and between the 26th and 27th degrees of north latitude. The country is in general flat, except on the banks of the Ganges, where the villages are situated, being usually surrounded by mango trees. The whole territory is fertile, and in a progressive state of prosperity, under the administration of the British, to whom it was ceded in 1801. Korah is the name of the principal town, in the province of Allahabad. The travelling distance is sixty-seven miles from Lucknow, and 301 from Delhi. Long. 80. 40. E. Lat. 26. 6. N. This is also the name of a village in Cutch, situated about ten miles south from Luckput Bunder, on the road from that place to Mandavee, a sea-port on the Gulf of Cutch. Lat. 23. 38. N.

KORDOFAN, a country of Central Africa, situated between the kingdoms of Darfoor and Sennaar. Little can be said of it, except that from time immemorial an inveterate animosity has subsisted between the Foorians and Kordofanese, arising principally from mercantile jealousy, as the country of the latter lies in the route to Sennaar and Suakem, the most direct line of communication with Mecca. The governors of Kordofan had for a long time been deputed by the Mek of Sennaar; but, in consequence of the weakness and dissensions of the latter kingdom, the power was usurped by the Foorian sultan. But the enterprising ruler of Egypt having reduced all the provinces of Africa as far as Sennaar, both Kordofan and Darfoor were enumerated among the kingdoms which now acknowledge by a tribute the conqueror of Egypt and Arabia. The country is of an arid character, destitute of any thing like a river or lake. The tropical rains, however, which fall at a certain season with great violence, inundate a considerable portion of the country, and thus, affording moisture to vegetation, agricultural operations are carried on. These are sufficient to produce wheat, and *doku*, a species of millet. The king enjoys absolute authority, but policy compels him to court his warriors, who, like those of Bornou, are invested in chain armour. What the number of inhabitants occupying this rude tract of country may be, it is impossible to say.

KORDOS, the ancient Corinth, a town in European Turkey, in the peninsula of the Morea, near the Gulf of Lepanto. It is the seat of a great archbishop, and contained about 500 houses, with 4000 inhabitants. Long. 23. 3. 10. E. Lat. 37. 55. 54. N.

KORNA, a flourishing little village of Irak Arabi. It is situated at the confluence of the Euphrates and the Tigris, and carries on some trade with Bassora. It was recommended by Sir J. Malcolm as a fort which might

Korotscha || Kosciuszko.

be occupied and fortified, and from which the predatory Arabs might be kept in check.

KOROTSCHA, a city of European Russia, in the province of Kursk, the capital of a circle, and standing on a river of the same name. It contains six churches, 1033 houses, and 9800 inhabitants. Long. 36. 57. E. Lat. 50. 45. N.

KOSCIUSZKO, Thaddeus, a Polish general, less celebrated for his exploits than for his attachment to the independence of his country, was descended of a noble but not opulent family, in the province of Lithuania. He was educated in the school of cadets at Warsaw, and made such progress in drawing and in mathematics, that he was named one of four pupils destined to travel at the expense of the state, in order to improve their talents by observation and inquiry. He consequently repaired to France, and having there passed several years devoted to study, returned to his native country enriched with new acquisitions. He obtained the command of a company, and proposed to prosecute the military profession in the Polish army, when the consequences of an unfortunate attachment for the daughter of the Marshal of Lithuania blighted his prospects, and forced him to leave his country. He proceeded to North America, which had just declared itself independent; served as adjutant to General Washington in the war which the revolted colonies had to maintain against the mother country, was decorated with the order of Cincinnatus, and returned to his own country, where he lived in retirement until 1789. About this period he was promoted to the rank of general-major by the Diet, which was then making vain efforts to restrain the influence of foreign powers. Kosciuszko was at that time little known; but in 1792 the affair of Dubienka, where with four thousand men he defended for six hours a post attacked by fifteen thousand Russians, gained him much reputation. He served, with equal distinction, during the whole campaign of that year, under the young Poniatowski; but the weakness of Stanislaus rendered fruitless the most generous efforts to maintain the independence of his country. He submitted to the conditions which were imposed upon him by Russia, and, under the appearance of a treaty of peace, signed the ruin of Poland. The bravest officers of the Polish army, unable to support the disgrace thus incurred, gave in their resignation. Kosciuszko was amongst the number; but having become an object of extreme suspicion to the enemies of his country, he found himself obliged to quit Poland; a circumstance which added much to his credit with the patriotic party, and caused him to be declared a French citizen by the Legislative Assembly of France. He afterwards retired to Leipzig, where his friends in Warsaw, having decided to make a new effort against the Russians, apprised him that he had been chosen as their chief. Kosciuszko did not refuse the perilous honour thus conferred on him; but, convinced that the means which his party had at their disposal were still insufficient, he resolved to proceed circumspectly, and, in order to avoid suspicion, undertook a journey to Italy, where he passed several months. At the beginning of 1794, however, having learned that it was no longer possible to restrain the impatience of the Poles, he drew near to the scene of approaching action, and reached Cracow at the moment when Medalinski had raised the standard of insurrection, and when he himself had just been declared generalissimo of the national forces. Finding himself thus invested with dictatorial power, in circumstances of great difficulty, he was careful not to abuse the trust reposed in him; and, by his conduct in every instance, he amply justified the choice of his countrymen. Master of Cracow, he published a manifesto, and immediately marched against the Russians at the head of a corps of five thousand men. He encountered the enemy, in number about ten thousand, at Wralawice, and, after a combat of four hours, completely defeated them. This first success produced a general rising; Warsaw was delivered from the presence of the Russians; and Kosciuszko soon saw himself at the head of an army of fifty thousand combatants, including about twenty-five thousand regular troops. With this comparatively small force the Polish general-in-chief had to make head at once against the Russians and the Prussians. Frederick William II., who had just failed in his contest with the French, appeared desirous to avenge himself for this affront on the Poles; and, at the beginning of 1794, he marched against Warsaw, at the head of forty thousand men. Kosciuszko, who, upon this point, could not oppose to him more than fifteen thousand men, had, nevertheless, the courage to attack him at Szezekocin, on the 8th of June 1794; but, after a murderous combat, in which he had two horses killed under him, he was obliged to retire to the entrenched camp that covered the capital, where, for two months, he resisted the most impetuous attacks and reiterated assaults. At the same time, he contrived to restrain and keep in order a furious populace, prone to give way to the greatest excesses. Scarcely had he been delivered from the Prussians, in consequence of the diversion which the insurrection of Great Poland operated in his favour, when Kosciuszko saw advancing against him the Russian army under Suwarow, and also that commanded by Fersen. It was in vain that he attempted to prevent the junction of these two armies. On the 4th of October, being attacked at Macijowice, by very superior forces, he obstinately disputed the victory during the whole day; but at length he sank down pierced with wounds, exclaiming, as he fell, *Finis Poloniæ*. He was about to expire under the sabres of the Cossacks, when being happily recognised, he was immediately surrounded with the respectful attentions of his enemies. Having been sent as a prisoner to St Petersburg, he remained two years confined in a dungeon, whence he was not liberated until after the death of the Empress Catharine. Paul I. immediately after his accession set him at liberty, and loaded him with marks of esteem and regard. The first use which Koscinszko made of his liberty was to proceed to England, and thence to America, where he passed several years amongst his old companions in arms. In 1798 he returned to France, where he was received with much distinction, and learned that a great number of his countrymen had enlisted under the banners of the new republic. Those who served in the army of Italy sent him the sabre of John Sobieski, which had been found in the Casa di Loretto. From this time he lived either at Paris or at a country-house which he had purchased near Fontainebleau. When Napoleon was about to invade Poland in 1807, he wished to avail himself of the name of Kosciuszko, in the hope of thereby inducing the people of that country to revolt against the Russians. But the Polish general had too much knowledge and experience not to divine the object for which recourse had been had to him, and he answered by positively refusing to comply with the imperial invitation. Nevertheless there was published in the journals a proclamation fabricated in his name, and addressed to the Poles. But although it was not till 1814 that he had an opportunity of denouncing this fraud, yet the truth had long been known in Europe, and the hero of Poland had never ceased to be an object of veneration, even when the government of Bonaparte treated him as a suspected person. When the Russians penetrated into Champagne in 1814, they learned with surprise that their ancient enemy was living peaceably in the immediate vicinity. All those who had an opportunity of visiting his retreat testified their regard for him in the strongest manner; and the Emperor Alexander himself had a long interview with the veteran and patriotic soldier. Nothing could induce Kosciuszko to return to his native country. In 1815 he made a tour in Italy, and afterwards established himself at Saleure in Switzerland, where he died on the 16th of October 1817. On the intelligence of his demise, the whole of Europe resounded with his eulogium; amongst all nations, and in every country, justice was equally rendered to the brave soldier and the true patriot, who, without any other object than the independence and welfare of his country, had exposed himself to the greatest perils, and the most painful sacrifices. His mortal remains were interred in the cathedral at Cracow, between those of John Sobieski and of Joseph Poniatowski. See Poland. (A.)

KOSELSK, a city of the province of Kaluga, in Russia, the capital of a circle of the same name. It stands at the junction of the river Schisbra with the Dragunka, and is the best built city of the province. It contains broad streets, a spacious market-place, seven churches, four of them of stone, and 559 houses, with 3800 inhabitants, who have considerable trade by the two rivers. Long. 35. 25. E. Lat 54. 12. N.

KOSFELD, a city, the capital of a circle of the Munster division of the province of Westphalia, in Prussia. It stands on the river Berkel, has a fortress adjoining, and contains two churches, 490 houses, and, including the garrison, 5850 inhabitants. There are linen and woollen manufactures. Long. 7. 7. 17. E. Lat. 51. 57. 10. N.

KOSLIN, a circle of the Prussian government of Pomerania, which extends over 5687 square miles, comprehending twenty-eight cities and towns, and 1196 villages and hamlets, containing, in 1827, 303,836 inhabitants. It stretches along the shore of the Baltic Sea. The chief place is the city of the same name, which contains the several boards of administration for the province, and 556 houses, with 6440 inhabitants. Long. 16. 15. 55. E. Lat. 54. 12. 7. N.

KOSLOW, a city of the Russian province Tambow, the capital of a circle of the same name, on the river Woronesh. It contains three wooden and five stone churches, a convent, and 1237 houses, with 8060 inhabitants, who trade in salted fish, hides, tallow, and other produce of the soil. Long. 40. 12. E. Lat. 54. 13. N.

Koslow, a city of the Russian province of Taurien, the capital of a circle of the same name. It stands at the bottom of a deep bay on the Black Sea. It has been declared a free port ever since 1798, and has a quarantine station. Large quantities of produce are shipped from it, consisting of wheat, salt, iron, wool, linen, leather, horses' tails and hair, hides, and tallow. It contains 928 houses, and, according to Pallas, 11,500 inhabitants. It is considered to be unhealthy, and the water is not very good. Long. 33. 20. E. Lat. 45. 15. N.

KOSTENDIL, a city of Turkey in Europe, the capital of a circle of the same name, in the province of Rumili. It is an open town, on the river Egrifu, at the foot of the mountain of that name. It contains many warm baths, and has a population of 8000 persons.

KOSTROMA, a province of European Russia, to the eastward of Jaraslow, extending over 39,710 square miles. It comprehends seventeen cities or towns, and 851 parishes, whose population amounts to 1,422,000 souls. The nobility are numerous, and hold two thirds of the land, and of the peasants who work upon it. It is a level district, with a few elevations near the banks of the rivers; and it is in many parts covered with forests, which yield excellent timber. The Wolga is the chief river, and is navigable, as are the Kostroma and the Unscha. The soil is by no means fertile, but it produces sufficient corn for the inhabitants, and is enabled to grow good flax and hemp. The pastures maintain cattle, which furnish hides and tallow. The rivers abound with salmon, sturgeon, and other fish. The females spin yarn in most of the cottages, and it is woven and bleached within the province. The several branches of industry enable an exportable surplus of hemp, flax, tallow, hides, dressed leather, fish, mats, bark, tar, soap, and some iron. The navigation of the Wolga is a source of commerce. The city of Kostroma, the capital of the province, and of the circle of its own name, is at the junction of the Kostroma with the Wolga. It is the seat of an archbishop, and of the boards of revenue and law; is surrounded with walls, lately converted into promenades; and contains fifty churches, including the cathedral, an ecclesiastical seminary, a gymnasium, several hospitals, and 1057 houses, with 8200 inhabitants. The leather made here is celebrated throughout Europe, and occupies eighteen considerable tanneries in preparing it. There is also a trade in sailcloth and other linen. Long. 41. 7. 31. E. Lat. 57. 45. 40. N.

KOSZOG, a city of the circle of Eisenburg, in the province of Farther Danube, in the kingdom of Hungary. It is sometimes called Guns, from the river of that name, on which it is built. It has some trade in internal productions, and contains 576 houses, with 5310 inhabitants, mostly of German origin. Long. 16. 27. 58. E. Lat. 47. 22. 54. N.

KOTBUS, a city, the capital of the circle of the same name, in the Prussian province of Brandenburg, on the river Spree. It is a considerable manufacturing place, with 739 houses, and 6430 inhabitants. It has a good internal trade by the navigable river.

KOTHEN, a city, the capital of the duchy of Anhalt-Kothen, in Germany. It is the residence of the sovereign, and the seat of the civil and ecclesiastical branches of the administration. It is on the river Ziathe, which runs to the Elbe, on a level and fertile plain. The palace is remarkable for its hall, decorated with the arms and the proverbs of Prince Ludwing, built in 1617. It contains 740 well-built houses, and 5500 inhabitants. It has three churches and several public buildings, and the institutions adapted to a contracted independent state. The trade is mostly dependent on the wants of the court.

KOTTERUS, Christopher, was one of the three fanatics whose visions were published at Amsterdam in 1657, with the title of *Lux in tenebris.* He lived at Sprotta, in Silesia, and his visions began in 1616. He fancied he saw an angel under the form of a man, who commanded him to go and declare to the magistrates, that, unless the people repented, the wrath of God would make dreadful havock. The elector palatine, whom the Protestants had declared king of Bohemia, was introduced in these visions. Kotterus waited on him at Breslau in December 1620, and informed him of his commission. He went to several other places, and at last to the court of Brandenburg. As most of these predictions promised felicity to the elector palatine, and unhappiness to his imperial majesty, the emperor's fiscal in Silesia and Lusatia got him seized, set on the pillory, and banished the emperor's dominions. Upon this he went to Lusatia, and there lived unmolested till his death, which happened in 1647.

KOTOO, one of the small Friendly Islands, scarcely accessible, owing to the coral reefs that surround it. It is sixteen miles north of Annamooka. Long. 185. 11. E. Lat. 19. 58. S.

KOTTIAR, a district of Ceylon, situated on the eastern side of the island, between the eighth and ninth degrees of north latitude. Cinnamon, betel-nuts, cocoa-nuts, and timber, form its chief produce.

KOTTILGHUR, a fortress of Hindustan, in the province of the Northern Circars, situated on the summit of a very high and inaccessible hill. It consists of a fort and citadel, which is capable of making very great resistance; though it was taken by the British in 1817, with little resistance.

Kotzebue.

KOTZEBUE, AUGUSTUS FREDERICK FERDINAND VON, a prolific German dramatist and miscellaneous writer, was born on the 3d of May 1761, at Weimar, where his father was a counsellor of legation. He early evinced a propensity to poetry, and, whilst yet a boy, the representation of a play which he witnessed inspired in him such a love of the drama as determined his future destiny. He received the rudiments of his education at his native place, and when he was about sixteen years of age he entered the university of Jena. Here he remained one year; but certain family circumstances occurred which induced him to remove to Duisburg, where he studied for a short time at the university, and returned to Jena in 1779. He was destined for the profession of the law, but the master passion predominated; and in gratifying his love of the drama, as well as literature in general, he consumed no inconsiderable portion of his time. If at this period he did not display great talent, he at least evinced wonderful versatility. Tragedy, comedy, ballads, essays, and other species of literary composition, came rapidly from his prolific pen. Their merits, however, he himself confesses in his autobiography, were exceedingly equivocal, although some of his plays were acted with applause. In his nineteenth year, he closed his studies at Jena with taking the character of an opponent at a doctor's degree. Soon afterwards he returned to his native place, where he diligently applied himself to the pandects, and was admitted as an advocate. But his addresses to the muses were still as assiduously paid as ever; and, in the ardour of his desire for distinction, he tried his skill in almost every species of composition, imitating, as caprice or admiration predominated, all the great writers of Germany, Schiller, Göethe, Wieland, Hermes, and others.

In 1781, on the invitation, it is said, of the Prussian ambassador, Kotzebue went to St Petersburg, where he obtained a situation under Von Bawr, general of engineers. The latter became his warm friend, and recommended him to the empress, who, on the death of Bawr, which occurred about two years afterwards, nominated him a counsellor. His imperial patroness first placed him in a judicial situation at Revel, and finally appointed him president of Esthonia, on which occasion he was ennobled. His literary ambition kept pace with his growing fortunes, and drama succeeded drama from his pen, with great, if not increasing rapidity. In 1790, on a journey to Pyrmont, he published his Doctor Bahrdt with the Iron Forehead, under the name of *Knigge;* a work which created a considerable sensation at the time of its appearance, but by which he lowered himself not a little in public estimation. Having received his dismission from the imperial service, he retired for a time to an estate which he possessed at some distance from Narva: but, in 1797, he returned to Weimar, with a pension of 1000 guilders. Three years afterwards, he was induced to pay a short visit to Russia; but he had scarcely crossed the frontiers of the empire when he was arrested by order of Paul I. and sent to Siberia. This treatment of Kotzebue is said to have originated in a suspicion of the autocrat that he was the author of some political pamphlets, in which the emperor was personally attacked; but the exile was kept entirely ignorant of the cause of his banishment. He was, however, shortly afterwards recalled, and, as he informs us himself, well received by the emperor, who confided to his direction the theatre of St Petersburg.

After the death of Paul I. Kotzebue returned to Weimar, and in 1802 was admitted a member of the Academy of Sciences at Berlin. Some disputes which he had with Goëthe and the Schlegels induced him to remove to Paris, where the French literati flattered his love of adulation by the attentions which they paid him. It is not much to his credit that he repaid their kindness by the publication of a calumnious work entitled My Recollections of Paris. The Italians were treated in the same spirit of illiberality in his Recollections of Rome and of Naples. About the end of 1803 he commenced, in conjunction with Merakel, a journal entitled Der Freymüthige, The Sincere, in which Napoleon was virulently attacked. In 1806 he went again to Russia, and lived from 1807 on his estate in Esthonia, never ceasing to write against the imperial usurper of France. Literature and politics continued to engage the pen of Kotzebue until 1813, when, as counsellor of state, he followed the Russian head-quarters during the campaign of that year; and, in order more effectually to excite the nations against Napoleon, he published in Berlin the Russian-German National Gazette (*Volksblatt*). After the affairs of Europe were decided by the victory of Waterloo, he went to St Petersburg; but was in 1817 commissioned by the Emperor Alexander to return to his own country, and report upon the state of literature and public opinion, for which he was to receive a salary of 15,000 roubles. He who had exerted himself so much in favour of Russia, sometimes, it is affirmed, at the expense of his native country, was not likely to be warmly welcomed on his return home. From the first he was looked upon as a spy; and the zeal which he displayed in his new employment soon confirmed this opinion, and prepared the way for his destruction. He established a literary weekly paper, in which judgment was passed on the publications of the day, and political opinions advanced, at once dishonourable and obnoxious to Germany, then awakening from its torpor, and heated with the expectation of concessions on the part of its rulers, and by delusive anticipations of representative systems. In his journal Kotzebue steadily ridiculed every attempt to form liberal institutions; and not only was every species of political amelioration opposed, but a marked enmity to the liberty of the press was exhibited. A private communication of his to the emperor of Russia, which had been obtained, it matters not how, was published in a German paper, and republished throughout the country; and its appearance excited a strong feeling of hostility and indignation against the author. Shielded as he was by the power of the autocrat, he found it necessary to quit Weimar for Manheim, where his literary and diplomatic labours were resumed with increased activity. Unfortunately for him, he began to point his pen more directly against the enthusiastic anticipations and theoretical notions of liberty which had become the distinguishing characteristic of the great mass of the students at the German universities. A spark of dangerous enthusiasm caught the heated and disordered mind of a young student named Sand, who doomed the versatile dramatist and venal party writer to the death of a Cæsar, under the impression that he was only performing an act of heroic virtue in the cause of national liberty. Having obtained admission into the house of his victim, he deliberately murdered him, on the 23d of March 1819, after which he gave himself up to justice, and suffered on the scaffold. Kotzebue was three times married, and left thirteen children. He wrote about a hundred dramas, the best of which are the comedies, and even these are far from being first-rate productions. As a dramatist he is more artificial than natural, and more melodramatic and picturesque than profound in the knowledge of the human heart, or happy in the concoction of incident or illustration of manners. Some of his plays, however, have been translated into English, and adapted to the British stage with great success. His Misanthropy and Repentance, under the title of the Stranger, is a stock piece; and his Spaniards in Peru, or the Death of Rolla, metamorphosed into Pizzaro by Sheridan, was the most successful play ever produced in this country. Kotzebue wrote a history of the German empire, and the Early History of Prussia; but as a historian he is held in little esteem by his countrymen. (R. R. R.)

KOUANGNAN-FOU, a city of China, of the first rank, in Yunan, separated from the rest of the province by frightful mountains. The inhabitants are stigmatised by the Chinese as barbarous. Long. 106. 14. E. Lat. 30. 32. N.

KOUANGSIN, a city of China, of the first rank, situated on a river which falls into the Poyang Lake. It is surrounded by lofty mountains, and carries on considerable manufactures of paper and candles. Long. 117. 44. E. Lat. 28. 27. N.

KOUBCABEIA, a considerable town of Darfoor, in Central Africa. It constitutes the key of the western road through the country, and is the depôt of all the merchandise brought from the west. A market is held here twice a week, the chief medium for goods of small value being salt. The inhabitants obtain this article by collecting and boiling the earth of those places where horses, asses, and other animals, have long been stationary. This market is celebrated for the quantity of *tokeas*, or coarse cotton cloths, here disposed of, and for the manufacture, if such it may be called, of leather sacks for corn, water, and other purposes. The inhabitants are a mixture of Foorians, who speak their own language; Arabs, Fellatahs, and individuals from Bengoo, and other western countries.

KOULI KHAN, Thamas, or *Schah Nadir*, was not the son of a shepherd, as the authors of the English Biographical Dictionary assert; his father being chief of a branch of the tribe of Affchars, and governor of a fortress erected by that people against the Turks. Upon his father's death, his uncle usurped his government, under the pretext of taking care of it during the minority of Kouli Khan, or, more properly, young Nadir. Disgust at this affront made him commence adventurer. He entered into the service of the beglerbeg or governor of Muscada, in Khorassan, who, discovering in him strong marks of a military genius, promoted him to the command of a regiment of cavalry. In 1720, the Usbec Tartars having made an irruption into Khorassan with 10,000 men, the beglerbeg, whose whole force consisted only of 4000 horse and 2000 infantry, called a council of war, in which it was declared imprudent to face the enemy with such an inferior force; but Kouli Khan proposed to march against the enemy, and engaged to conduct the expedition, and to be answerable for the success of it. He was accordingly made general, defeated the Tartars, and took their commander prisoner. Hossein Beglerbeg received him at his return with marks of distinction; but growing jealous of his rising fame, instead of obtaining him the rank of lieutenant-general of Khorassan, as he had promised, obtained it for another; which so exasperated Kouli Khan, that he publicly complained of the governor's ingratitude and perfidy, who thereupon broke him, and ordered him to be punished with the bastinado so severely, that the nails of his great toes fell off. This affront occasioned his flight, and his joining a banditti of robbers (not his stealing his father's or his neighbour's sheep). The rest of his adventures are too numerous to be inserted in this work. In 1729 he was made general of Persia by Schah Thamas, and permitted to take his name *Thamas*, and that of *Khuli*, which signifies *slave*. His title therefore was *The Slave of Thamas*, but he was ennobled by the addition of Khan. In 1730, he fomented a revolt against his master, for having made an ignominious peace with the Turks; and having the army at his command, he procured his deposition, and his own advancement to the throne. In 1739, he conquered the Mogul empire; and from this time growing as cruel as he was ambitious, he at length met with the usual fate of tyrants, being assassinated by one of his generals, in league with his nephew and successor, in 1747, aged sixty.

KOUMA, a river of Asiatic Russia, which rises in the Caucasus, between the Terek and the Cuban, and, taking an easterly course, loses itself in the sand before reaching the Caspian Sea.

KOUMISS, a sort of Tartar wine, made of fermented mare's milk. It is used by the natives as their common beverage during the season of it, and often serves them instead of all other food.

KOUMYKS, a Tartar and Mahommedan tribe, who live in a sandy plain at the foot of the Caucasus, on the right bank of the Terek. They are nominally subject to Russia, though this does not restrain their predatory incursions into its vicinity. They carry on some trade on the Caspian Sea.

KOUZNETZK, a small fortified town in Asiatic Russia, and capital of a district of the same name, in the government of Tomsk. It was founded in 1618; and the sable being here of peculiar beauty, the place is a great resort of fur-merchants. Population 500. Long. 87. 30. E. Lat. 53. 20. N.

KOWNO, a city of the province of Wilna, in Russia, the capital of a circle of the same name, on the river Wilna. It contains one Lutheran and ten Catholic churches, is an old, well-built town, with 608 houses and 3200 inhabitants. It has some trade in linen, and, by the river, which runs to the Niemen, in corn. Long. 26. 53. 55. E. Lat. 54. 53. 30. N.

KRAILSHEIM, a town of Wirtemberg, in the circle of the Jaxt, and the capital of a bailiwick of the same name, which extends over 154 square miles, and contains a population of 22,500 persons. The town is on the Jaxt, contains two churches, 420 houses, and 2900 inhabitants, employed in linen, cotton, and other manufactures.

KRAKATOA, the southernmost island of a group situated in the Straits of Sunda, about ten miles in circuit. It contains a hot spring, used by the natives as a bath, and is esteemed more healthy than any of the neighbouring islands. The coral reefs with which it is surrounded afford abundance of turtle. It has a high peaked hill on the south, which lies in long. 105. 15. E. lat. 6. 9. S.

KRAKEN, the name of an animal of a monstrous size, supposed to have been seen at sea, in the existence of which the weakness and credulity of the fishermen have excited the belief of even respectable naturalists, and amongst others Bishop Pontoppidan, who describes it in his *Natural History of Norway*. It is probable that the whole depends on certain optical appearances arising from a peculiar state of the atmosphere, which thus exhibits to the deluded fancy something of the form of a huge animal.

KRANTZ, Albert, a celebrated German chronicler, was born at Hamburg about the middle of the fifteenth century. Having finished his studies, he set out upon his travels, in the course of which he visited several parts of Europe, attending the prelections of the most distinguished professors, cultivating the society of the learned, and exploring public libraries, by which means he made acquisitions in knowledge equally varied and extensive. He took his degree at Rostock, and on that occasion supported several theses with so much distinction that he was retained to teach philosophy and theology. Krantz was rector of this university in 1482. But being recalled to Hamburg, he was provided with a canonry in the cathedral, and divided his time between preaching and teaching theology. Elected syndic of Hamburg in 1489, he assisted the same year at the assembly of Wismar, where the interests of the Hanseatic towns were discussed. They deputed him to proceed to France in 1497 to demand a treaty, and to England in 1499 to solicit assistance against the pirates who infested the North Sea. In these different missions he evinced so much prudence, sagacity, and integrity, that John king of Denmark, and Frederick duke of Holstein, chose him, in 1500, to terminate the dispute which had arisen between them on the subject of the province of Ditmarsen. Krantz, having been named dean of his chapter in 1508, laboured with great zeal to remedy the disorders which had been introduced into ecclesiastical discipline; but it is only by a forced interpretation of some passages in his works, that Wolf, and after him Bayle, have endeavoured to make him be considered as one of the precursors of Luther. Krantz was witness to the first attacks of that reformer on the church of Rome, and condemned them. He died on the 7th of December 1517, and was interred near the eastern gate of his cathedral. Krantz was a very learned man; and the historical works which he left behind him are useful, notwithstanding the errors by which they are disfigured. Some critics have accused him of plagiarism and of bad faith; but he has found numerous apologists, amongst whom may be mentioned Cisner, who places him in the first rank of the writers of his age, not only for the elegance of style and the clearness of method, but also for the love of truth. Krantz was the author of, 1. Chronica Regnorum Aquilonarium, Daniæ, Sueciæ, Novoagiæ, Strasburg, 1546, in folio; 2. Saxonia, sive de Saxonicæ Gentis vetusta origine, longinquis ex-expeditionibus susceptis etc. libri xii. Cologne, 1520, in folio; 3. Vandalia, sive Historia de Vandalorum vera origine, variis gentibus, crebris e patria migrationibus, etc. Cologne, 1519, in folio; 4. Metropolis, sive Historia Ecclesiastica Saxoniæ, Basil, 1548, in folio; and some other works of little importance. (A.)

KRASNISTAW, a town of Poland, in the province of Lublin, the capital of a circle of its own name, on a lake and the river Wieprz. It is surrounded with walls, and defended by a citadel, and contains 481 houses, and 3240 inhabitants, of whom many are Jews. Long. 23. 1. 39. E. Lat. 50. 58. 46. N.

KRASNOIARSK, a town of Asiatic Russia, in the government of Tomsk, situated on a small river tributary to the Yenesei. The road to Irkoutsk passes through this place, through which there is a considerable transit of commodities for the trade with China and Eastern Siberia. The surrounding country is remarkable for fertility, and provisions are exceedingly cheap.

KRAW. This isthmus connects the Malay peninsula with the continent of Asia, and in the narrowest part does not exceed ninety-seven miles across from sea to sea.

KREMENTSCHUK, a city of the province of Pultowa, in Russia, the capital of the circle of the same name. It stands at the mouth of the Kagamlik, where that river falls into the Dnieper. Its fortifications have been turned into pleasant walks. It contains 1200 houses, and 8600 inhabitants. It enjoys considerable trade on the navigable river, in native products, and has some manufactures, and extensive fisheries on the Dnieper. Long. 33. 23. 40. E. Lat. 49. 3. 10. N.

KREMNITZ, a city of the circle of Barsch or Bars, in the Austrian kingdom of Hungary. The city, with its extensive suburbs, contains 1200 houses, and 9678 inhabitants. There is a college of mining, a mint where ducats are coined, a gymnasium, and a Lutheran grammar school. The chief employment is in the working of the silver and gold mines in the surrounding district, and purifying these metals. Long. 18. 32. 35. E. Lat. 48. 42. N.

KREMS, a city of Austria, in the circle of Manhartsberge, and province of the Lower Ens. It is on the Danube, is well built, and contains a nunnery founded for English females. There are some manufactories of vinegar, of mustard, and of linen goods, and some good wine is made. It contains 424 houses, and 3650 inhabitants. Long. 15. 30. 42. E. Lat. 48. 21. 39. N.

KREMSIER, a city of the circle of Prerau, in the Austrian province of Moravia, on the river March. It is the seat of the Archbishop of Olmutz, whose castle is here, with a fine gallery of pictures and a library of 30,000 volumes. It contains, besides the minster, six churches, 420 houses, and 4100 inhabitants, who successfully cultivate vineyards.

KRESTXY, a city of the province of Novogorod, in Russia, the capital of a circle of the same name, extending over 372 square miles, comprehending one city, 730 villages and hamlets, with 47,387 inhabitants. The city is on the river Khalowa, contains 450 houses, and 1874 inhabitants. Long. 32. 28. E. Lat. 58. 20. N.

KREUZ, a circle in the Austrian province of Croatia, which extends over 664 square miles, and comprehends two cities, two market-towns, and 294 villages and hamlets, with 66,885 inhabitants. The capital is a city of the same name, on the river Golkoniska, the seat of a bishop, with 302 houses, and 1819 inhabitants. Long. 16. 26. 58. E. Lat. 46. 1. 16. N.

KREUZNACH, a city of Prussia, the capital of a circle of the same name, in the province of Lower Rhine. It is on the river Nake. It contains 700 houses, and 7205 inhabitants. It has fabrics of leather, snuff, and soap, and very considerable establishments for salt refining, and has a lively trade in wine grown near it, and in oil, potash, corn, spirits, and clover-seed.

KRISHNA. See Kistna.

KROMY, a town of the province of Orel, in Russia, the capital of a circle of the same name, on the river Kroma. It contains seven churches and 300 houses, with 3100 inhabitants. Long. 35. 51. E. Lat. 52. 38. N.

KRONSTADT, a city of Hungary, in that division of the province of Siebenbergen denominated Sachsenland. It is on the frontier towards Wallachia, in a plain watered by numerous brooks, which unite to form the river Aluta. It is an irregular-built town, but surrounded with walls. It contains six Lutheran, two Greek, two Catholic, and one Unitarian church, and a Franciscan convent, with a church and cloth manufactory attached to it. It contains, including the suburbs, which are extensive, 3200 houses, and at the lowest estimate 25,000 inhabitants, among whom are Germans, Hungarians, Wallachians, Greeks, Armenians, and some Turks, who carry on a variety of manufactures for the supply of the home market. Long. 28. 28. 25. E. Lat. 45. 56. 30. N.

KROOK, a city of Persia, in the province of Kerman, and capital of the district of Nurmanshur. It is of a considerable size, and is surrounded with a deep ditch. 150 miles south-east of Kerman.

KROSSEN, a fortified city, the capital of a circle of the same name, of the Prussian province Brandenburg. It is on the Oder, near to where the Bober falls into that river. It contains 574 houses, and 3605 inhabitants. The manufactures are of cloth and hosiery.

KROTOSZYN, a city of Prussia, in the circle of the same name, of the province of Posen. It is a frontier place towards Poland, but now without fortifications, since the union of Posen with Prussia. It contains 535 houses, and 4860 inhabitants, speaking mostly the Polish language, and employed in manufactures of cloth, linen, leather, paper, and tobacco.

KRUMAU, a city of the circle of Budweis, in the Austrian kingdom of Bohemia. It is on the river Moldau, is fortified, and, with about 300 villages around it, forms a dukedom belonging to the Schwarzenburg family. The castle and part of the duchy is near the city, which contains 696 houses, and 4291 inhabitants, some of whom are stocking-makers, and others cloth and paper manufacturers. Near to it are the baths of Umlowitz, much frequented in summer; and some mines of silver, but feebly worked.

KTEIFA, a small town of Syria, in the pachalic of Damascus, on the borders of the Desert. It is surrounded with walls of sufficient strength to defend it against the travelling Arabs. It is twenty-two miles east-north-east of Damascus, and is supposed to be the ancient Adarisi.

KUARA, a very mountainous province situated in the western part of Abyssinia. It is a rugged, unhealthy country, and its chief importance consists in the gold which passes through it from the east. It receives a governor from Abyssinia when it dares not to do otherwise.

KUBBEER, a large salt lake, or rather marsh, of Persia, in the province of Irak. It runs from east to west about 150 miles, and is in some places thirty-five miles in breadth. There are roads through this morass, but they are not easy distinguished, and the unfortunate wanderer who misses them is in danger either of perishing in the swamp or of dying from thirst and heat. The road from Koom to Tehran crosses a part of this morass.

KUBBEES, a city of Seistan, in Persia, situated on the road from Kerman to Herat, in the midst of a desert, 150 miles north-east from Kerman, and 160 north-east from Yezd, and the whole intermediate space being an arid waste, intersected with one or two ranges of mountains. There is a path through this desert, by which couriers go; but the danger of perishing is so great, that a person of this description demanded 200 rupees from Lieutenant Pottinger, to carry a letter to his fellow-traveller, Captain Christie.

KUFA, a city of Irak Arabi, once a large and populous city, founded by Omar after the ruin of Ctesiphon, and the residence of the caliphs, until, owing to the vices of the inhabitants, the seat of government was removed to Bagdad. Little is left of this place but the mosque where Ali was assassinated, a plain edifice, in the form of a square, with a court in the centre, surrounded by a cloister. There is but one entrance, through an elegant gateway; and the walls being high, and flanked with bastions, give it more the appearance of a castle than a place of worship. The Mahommedans hold in high veneration the spot on which this mosque has been built; and their imams or priests, to add to its sanctity, have invented many wonderful stories concerning it. Four miles north of Meshed Ali.

KUFFSTEIN, a small city of the Austrian province of Tyrol, on the river Inn. It is remarkable for the strength of its works, which, in conjunction with those of the fortress of Geroldstein, opposite to it, defends one of the important passes between Italy and Germany.

KUILENBURG, a city of the Netherlands, in the province of Gelders, and circle of Thiel. It stands on the river Leck. It is surrounded with walls, and divided by the river into three parts, which are connected by handsome stone bridges. It is an increasing place, containing, in 1830, 4299 inhabitants, who are occupied in making silk goods, ribbons, and fire-arms.

KULM, a city, the capital of a circle of the same name, in the province of West Prussia, on a hill, at the foot of which the Vistula flows. It is the see of a Catholic bishop, and has an ecclesiastical seminary for that religion, with four professors and about 120 pupils. It contains 397 houses, and 3640 inhabitants. It was formerly a place of great consideration, and one of the Hanse Towns, but has declined. Long. 18. 20. 41. E. Lat. 53. 21. 6. N.

KULMBACH, a city of Bavaria, the capital of the bailiwick of the same name, in the circle of the Upper Maine. It is on the river White-Maine, in one of the finest situations of the circle. It is surrounded with walls, has a fine market-place, several public buildings, 437 houses, and 3420 inhabitants.

KUMBALIA, a town of Hindustan, in the Gujerat peninsula, situated about five miles from the Gulf of Cutch, and subject to the chief of Nooanager. It is a populous and well-built town, surrounded by a stone wall, with round bastions, and four gates, which are sufficient to keep the surrounding country in awe. This place is the resort of the Gogia Brahmins, who are attendants on Ranchor, an incarnation of Vishnu and Dwarca. Having accumulated fortunes from the offerings of the pilgrims resorting to the pagoda, they have retired to Kumbalia, which is well adapted for commerce, to which they are much inclined. The port of this place is Sirreyah, at which vessels anchor, and send up their cargoes in boats. Long. 69. 45. E. Lat. 22. 15. N.

KUMI, an island in the Eastern Seas, about three or four leagues in circuit, populous and cultivated. It is one of a cluster, consisting of six or seven others between Formoza and Japan, seen by Perouse. Long. 23. 16. E. Lat. 24. 33. N.

KUNASHIR, an island in the Eastern Seas, forming part of the small archipelago of the Kuriles. It is 100 miles long, and thirty-five broad. The Russians have erected a small fort on this island.

KUNCKEL, John, a celebrated Saxon chemist, was born in the duchy of Sleswick, in 1630. He became chemist to the elector of Saxony, the elector of Brandenburg, and Charles XI. king of Sweden, who gave him the title of Counsellor in Metals, and letters of nobility, with the surname of Louwensteing. He employed fifty years in chemistry, in which, by the help of the furnace of a glasshouse which he had under his care, he made several discoveries, particularly those of the phosphorus of urine. He died in Sweden in 1702, and left several works, some in German, and others in Latin; amongst which, that entitled *Observationes Chemicæ*, and the Art of Making Glass, printed at Paris in 1752, are the most esteemed.

KUNDAL, a town of Hindustan, in the province of Bengal, surrounded by a country which is one entire forest, abounding with all sorts of wild animals. Seventy-four miles south by west from Dacca. Long. 91. 18. E. Lat. 23. 12. N.

KUNDAPOOR, a sea-port town of India, in the province of Canara, situated near the mouth of a river, which is the boundary of the northern and southern divisions of Canara. On the north side of the river, Tippoo formerly had a dock, which is seldom used by the British. The town consists of 300 houses, and was formerly garrisoned by a detachment of native infantry. Long. 74. 47. E. Lat. 13. 33. N.

KUNEE, town of Hindustan, province of Delhi, and district of Sirhind. It is surrounded by a mud wall and a deep ditch, but was taken by the British in 1809, without resistance.

KUOPIO, a circle in Russian Finland, on the sea-shore, of the vast extent of 20,608 square miles, containing only one town and 4423 farms, with 144,500 inhabitants. The capital, of the same name, is a town in a peninsula on the Lake of Kallavesi, containing 160 houses, and 920 inhabitants. Long. 27. 24. 55. E. Lat. 62. 53. 43. N.

KUPH, an extensive ruined village of Syria, which appears to be the remains of a large town. The buildings appear like magnificent palaces. The style of architecture is of the fourth or fifth century; and the crosses over the door show the buildings to have been Christian. Thirty-five miles south-south-west of Aleppo.

KUR, the ancient Cyrus, the most considerable river of Georgia, in Asia. It has its rise, according to Sir R. Kerr Porter, in a branch of the Caucasian Mountains, from which issue several rivulets, which, uniting in one channel, take the name of Kur; and flowing thence through part of the Turkish dominions, gradually augments its stream by the reception of minor rivers in its course. From this point the Kur takes a south-east direction, fertilizing a country of as much beauty as grandeur. Its most considerable tributaries in this part of its course are, the Aluzan from the north-east, and the Araxes from the south, which falls into the Kur about seventy miles from its mouth. After this junction, the breadth and depth of the Kur are so much increased, that it immediately becomes navigable for larger boats. At fifty miles lower down, it divides itself into two noble branches, and so flows onward, through the province of Maghan, to the north-west coast of the Caspian, whence, by these double channels, it unites its waters with the sea. The banks are very high, and wooded.

KURDA, a town of Hindustan, in the province of Gujerat, situated near the north-west frontier, about three miles south of the town of Theraud. It is surrounded by a sandy and unproductive country.

KURGOMMAH, a town of Hindustan, in the province of Gundwana. It is situated in the middle of a very wild country inhabited by Goands, who are so uncivilized as not to know the value of the precious metals, their only currency being cowries or shells. Long. 82. 25. E. Lat. 23. N.

KURIL, or Kuriliski Isles, extending from north latitude 51. to 45. which probably once lengthened the peninsula of Kamtschatka before they were disjoined from it, are a series of islands running south from the low promontory Lopatka, which is distant one league from Shoomska, the most northerly of these. Of the twenty-one islands subject to the Russian empire, no more than four are inhabited. The rest of these islands remain wholly uninhabited, but are visited occasionally, for the purpose of hunting otters and foxes.

KURSK, a province of European Russia, which extends over 15,430 square miles, comprehending seventeen cities, 137 towns, 1532 villages and hamlets, and containing a population of 1,611,100 persons. It is between 50. 20. and 52. 26. north latitude, and is consequently in a temperate climate. It is an undulating district, with no elevations entitled to the name of mountains. Although well watered by the rivers Donez and its tributary streams, it is neither swampy nor marshy, but enjoys a dry soil. It is fertile, and the increase of corn from the same measure of seed is greater than in any of the provinces to the north of it. As the greater portion of the people are occupied in agriculture, the chief surplus produce consists of corn, amounting in some years to upwards of 4,400,000 quarters. This forms the chief commodity for exportation, besides which, corn, spirits, hemp and hemp oil, tobacco, hides, leather, wool, tallow, wax, honey, horses, and horned cattle, are supplied to the neighbouring provinces. From the want of navigable rivers, most of the commodities must be conveyed to the Wolga on wheel carriages, which, as the roads are bad, becomes very expensive. There are in this province a great number of nobles, who among them possess 239,000 peasants or slaves. The province is divided into fifteen circles. The city of Kursk is the capital of the province, as well as of the circle of that name. It is the seat of an archbishop. It stands at the junction of the rivers Kura and Tuskar, and has been fortified, but the walls are converted into pleasing promenades. It contains sixteen churches, two convents, an ecclesiastical seminary, 2340 houses, and 21,500 inhabitants. It is a place of extensive trade in wax, tallow, hemp, and the other productions of the soil, and the seat of some manufactures; and near it the gardens produce fruits that will not grow in the more northern parts of the empire. Long. 36. 22. E. Lat. 51. 43. N.

KURZOLA, an island in the Adriatic Sea, a portion of the Austrian province of Dalmatia. The extent is about 220 square miles. It is well wooded, and affords good ship timber. It yields good wine, and some corn, but is deficient in water. The inhabitants are 6440, of whom 1800 live in the fortified capital of the same name, in a narrow strait on the east end of the island.

KUSTER, Ludolf, a very learned writer in the eighteenth century, was born at Blomberg in Westphalia. When very young, he was, upon the recommendation of Baron Spanheim, appointed tutor to the two sons of the Count de Schwerin, prime minister of the king of Prussia, who, upon our author's quitting that station, procured him a pension of four hundred livres. He was promised a professorship in the university of Joachim, and, till this should become vacant, being then but twenty-five years of age, he resolved to travel. He read lectures at Utrecht, went to England, and thence proceeded to France, where he collated Suidas with three manuscripts in the king's library, which furnished him with a great many fragments that had never been published. He was honoured with the degree of doctor by the university of Cambridge, which made him several advantageous offers to continue there, but he was called to Berlin, and there installed in the professorship which had been promised him. He afterwards went to Antwerp; and being brought over to the Catholic religion, he abjured that of the Protestants. The king of France rewarded him with a pension, and ordered him to be admitted a supernumerary associate of the Academy of Inscriptions. But he enjoyed this only a short time, having died in 1716, at the age of forty-six. He was a great master of Latin, and wrote well in that language; but his chief excellence consisted in his skill in the Greek language, to which he almost entirely devoted himself. He wrote many works, the principal of which are, 1. Historia Critica Homeri; 2. Jamblicus de Vita Pythagoræ; 3. An edition of Suidas, Greek and Latin, in three volumes, folio; 4. An edition of Aristophanes, Greek and Latin, in folio; 5. A new edition of the Greek New Testament, with Dr Mills's Variations, in folio.

KUSTERDINGEN, a town of Wirtemberg, in the circle of the Black Forest, and bailiwick of Babenhausen. It contains 175 houses and 1230 inhabitants, who grow much flax, and convert it into linen and diaper cloth.

KUSTRIN, a city, the capital of a circle of the same name, in the province of Brandenburg, in Prussia. It is a strongly fortified place, with a fortress on the river Oder, surrounded by ditches and marshes, by which the approaches of assailants are impeded. It is one of the chief defences on the east of the kingdom, is always strongly garrisoned, and well stored with ammunition and provision, and commands a bridge over the river 880 feet in length. It contains 562 houses, and 6220 civil inhabitants. Long. 14. 35. E. Lat. 52. 35. N.

KUTTENBURG, a city of the circle Czaslau, in the Austrian kingdom of Bohemia. It is a well-built town, with a magnificent cathedral and thirteen other churches, and containing 746 houses and 6417 inhabitants. The chief employment is mining for silver, lead, and copper, in the country around. There is a house for smelting the silver, another for refining saltpetre, and several establishments for manufacturing the several metals.

KUTUBDEA, an island in the bay of Bengal, thirteen miles in length by four in breadth, adjacent to the district of Chittagong, being separated from it by a narrow strait two miles broad, into which a vessel, in case of distress, may safely run. In its vicinity are some valuable oyster-beds: the oysters are of an excellent quality, and are sent for sale to the Europeans at Dacca and Calcutta.

KUTY, a city of the circle of Kolomea, in the Austrian kingdom of Gallicia, on the river Czerny. It contains a Greek and an Armenian church, with 430 houses and 4110 inhabitants, of whom 520 are Armenians.

There is much occupation in the curing of leather, in a way similar to that followed in Russia.

KYLE, a district of Ayrshire, in Scotland. There are three districts in Ayrshire, Carrick to the south, Kyle in the middle, and Cunningham to the north. Carrick is divided from Kyle by the river Doon. The boundaries of Kyle are the river Doon on the south, and the river Irvine on the north. See AYRSHIRE.

KYPHONISM, KYPHONISMUS, or CYPHONISMUS, an ancient punishment frequently undergone by the martyrs in the primitive times, wherein the body of the sufferer was anointed with honey, and so exposed to the sun, that the flies and wasps might be tempted to torment him. This was performed in three ways. Sometimes they only tied the patient to a stake; at other times they hoisted him up into the air, and suspended him in a basket; and at others, again, stretched him out on the ground with his hands tied behind him. The word is originally Greek, and comes from κυφον, which signifies either the *stake* to which the patient was tied, the *collar* fitted to his neck, or the *instrument* with which they tormented him. The scholiast on Aristophanes says it was a wooden lock, or cage, and that it was called so from κυπτειν, to *bend*, because it kept the tortured in a bent posture; but others take the κυφον for a log of wood laid over the criminal's head, to prevent his standing upright; and Hesychius describes it as a piece of wood on which criminals were stretched and tormented. In effect, it is probable the word might signify all these several things. It was a generic term, and these were merely the species. Suidas gives us the fragment of an old law, which punished those who treated the laws contemptuously with kyphonism for the space of twenty days; after which they were precipitated from a rock, dressed in women's habit.

KYRAUT, a district of Northern Hindustan, situated between the twenty-seventh and twenty-eighth degrees of north latitude. It is bounded on the north by the Himalaya ridge, on the east by Bootan, on the south by Morung, and on the west by Nepaul, from which it is separated by a large tract little known to Europeans. The river Teesta is the principal river, and Damsong the chief town. It was conquered in 1769 by the rajah of Gorcah.

KYRAHGUR, a town of Hindustan, belonging to the grand rajahs tributary to the Nagpoor Mahrattas, in the province of Gundwana, eighty-six miles south-west from Ruttunpoor. Long. 81. 32. E. Lat. 21. 27. N.

KYREEGHUR, a town of Hindustan, in the province of Oude, situated on the east side of the Goggrah river, 102 miles north from Lucknow. Long. 80. 51. E. Lat. 28. 18. N.

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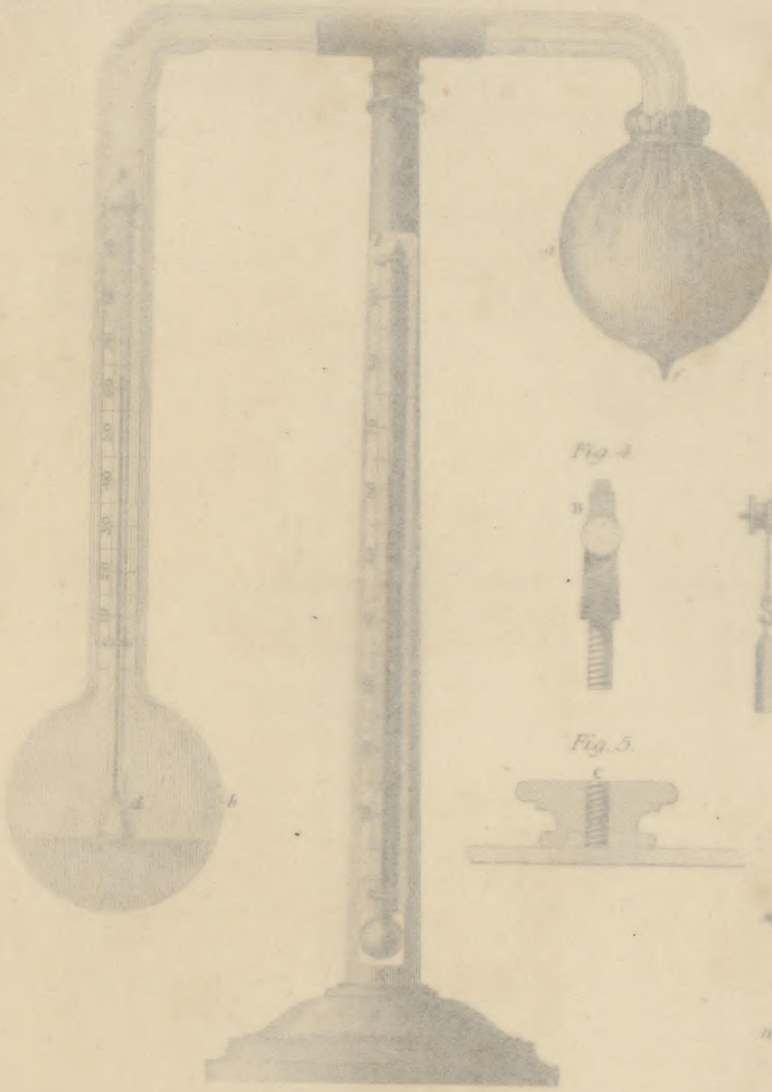

Fig. 8.
DANIELL'S HYGROMETER.

Fig. 2.

Fig. 7.

Fig. 4.

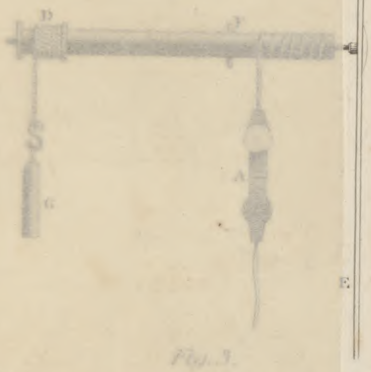

Fig. 6.

Fig. 5.

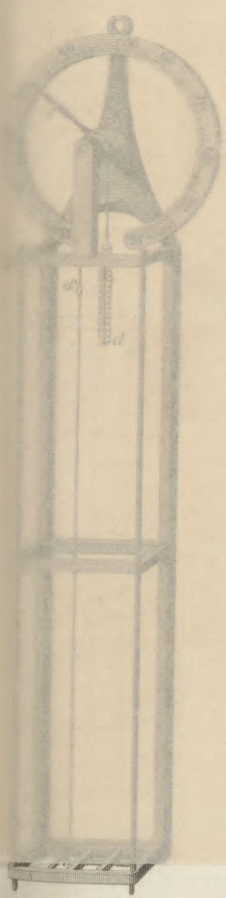

Fig. 1.
DE LUC'S
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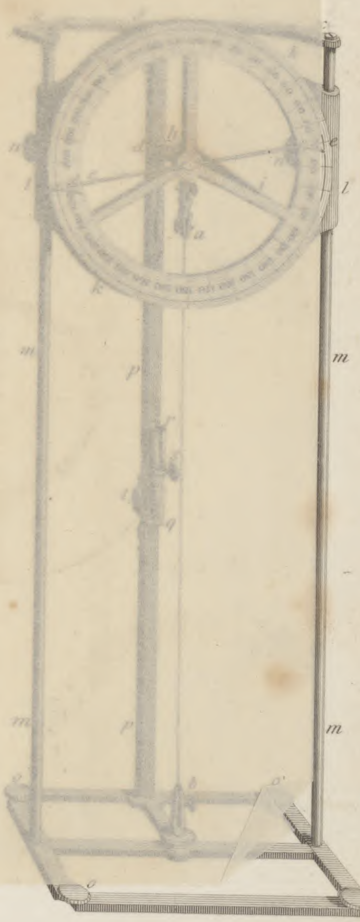
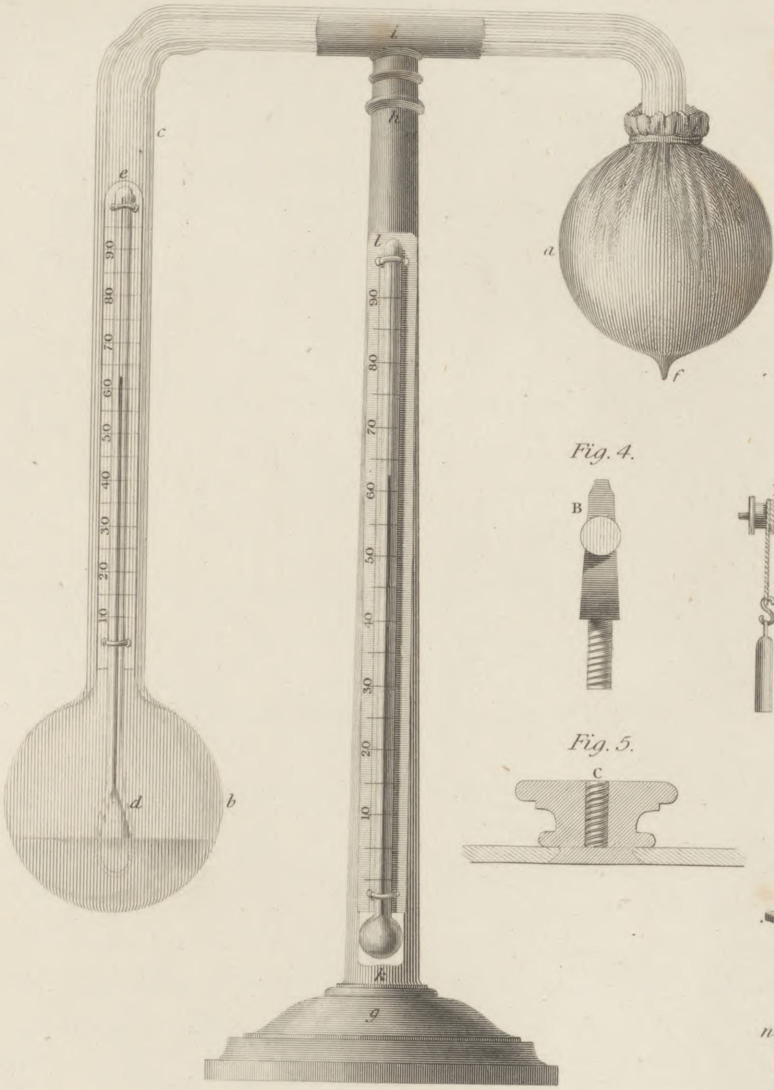


Fig. 3.
SAUSSURE'S HYGROMETER.

Fig. 9.

Fig. 8.
DANIELL'S HYGROMETER.



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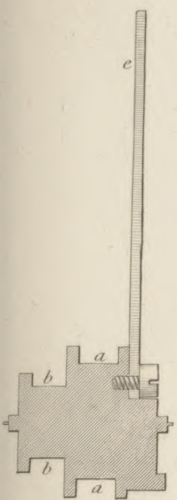


Fig. 7.

Fig. 4.

B

Fig. 6.

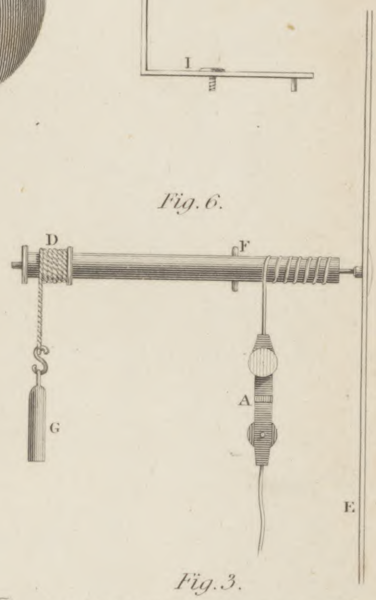


Fig. 5.

C

Fig. 1.
DE LUC'S,
WHALEBONE HYGROMETER.

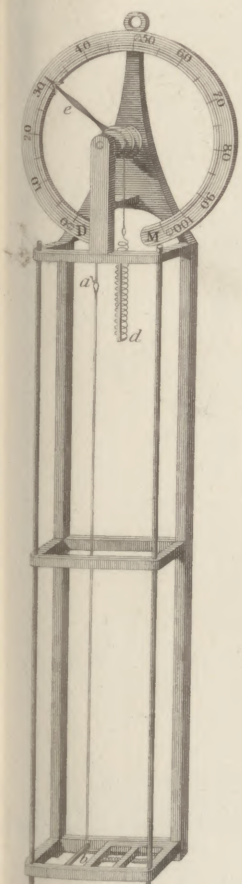


Fig. 3.
SAUSSURE'S HYGROMETER.

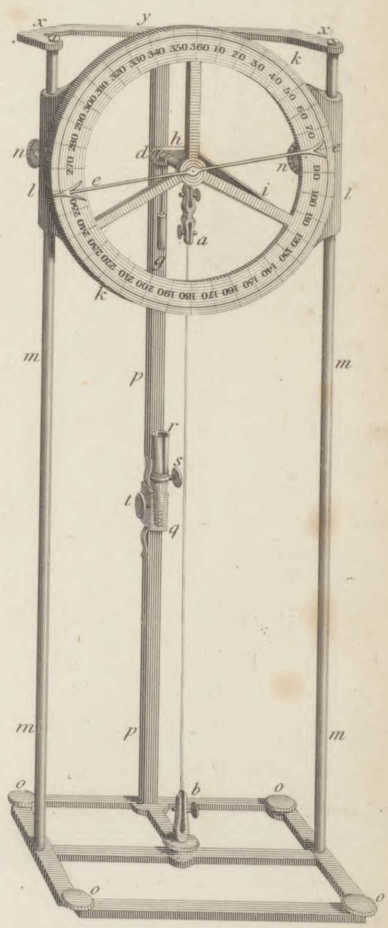
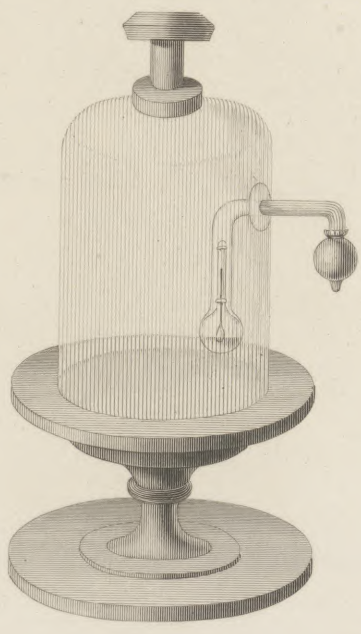
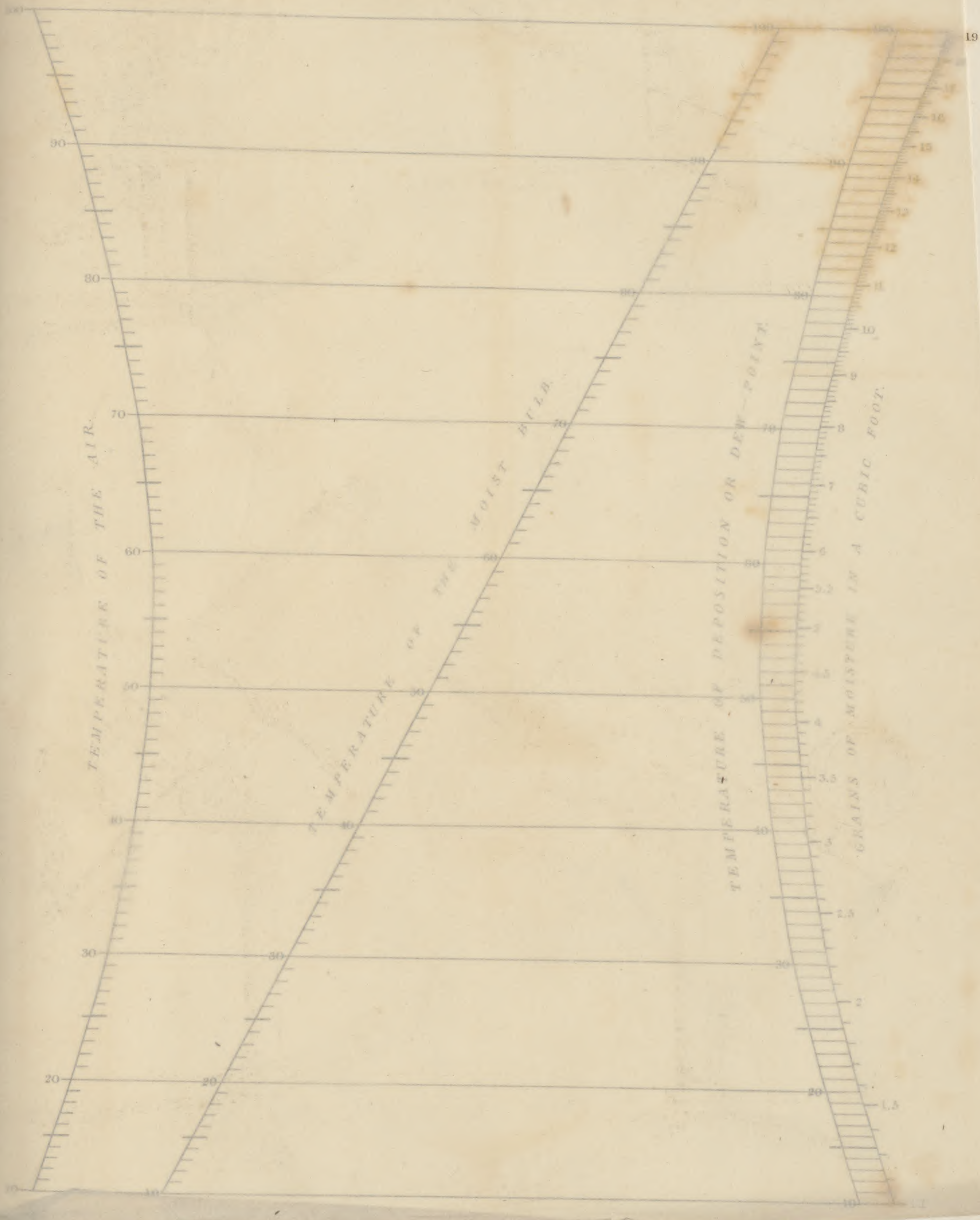


Fig. 9.



Engd by G. Aikman. Edinr

HYGROMETRIC SCALES.



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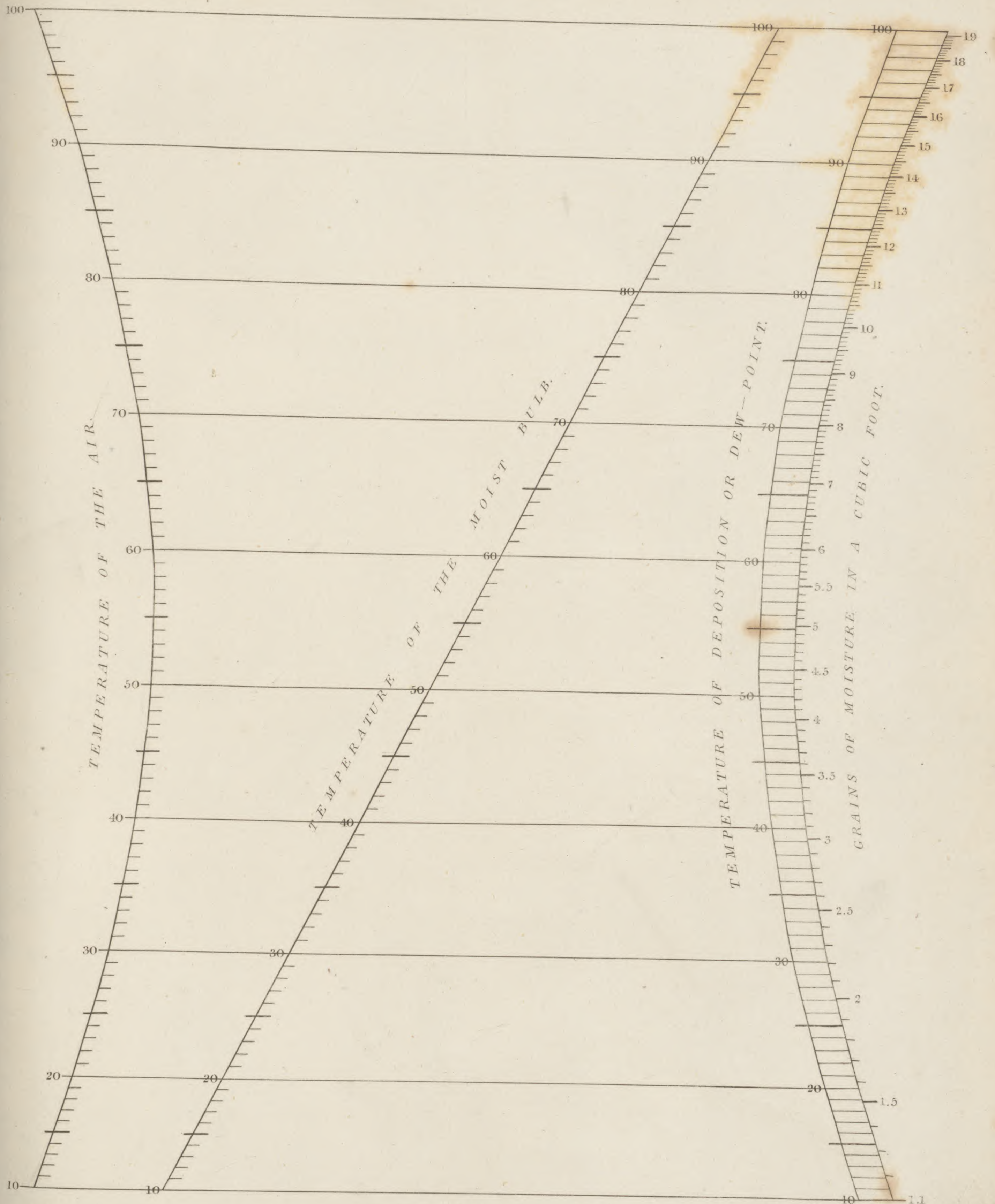
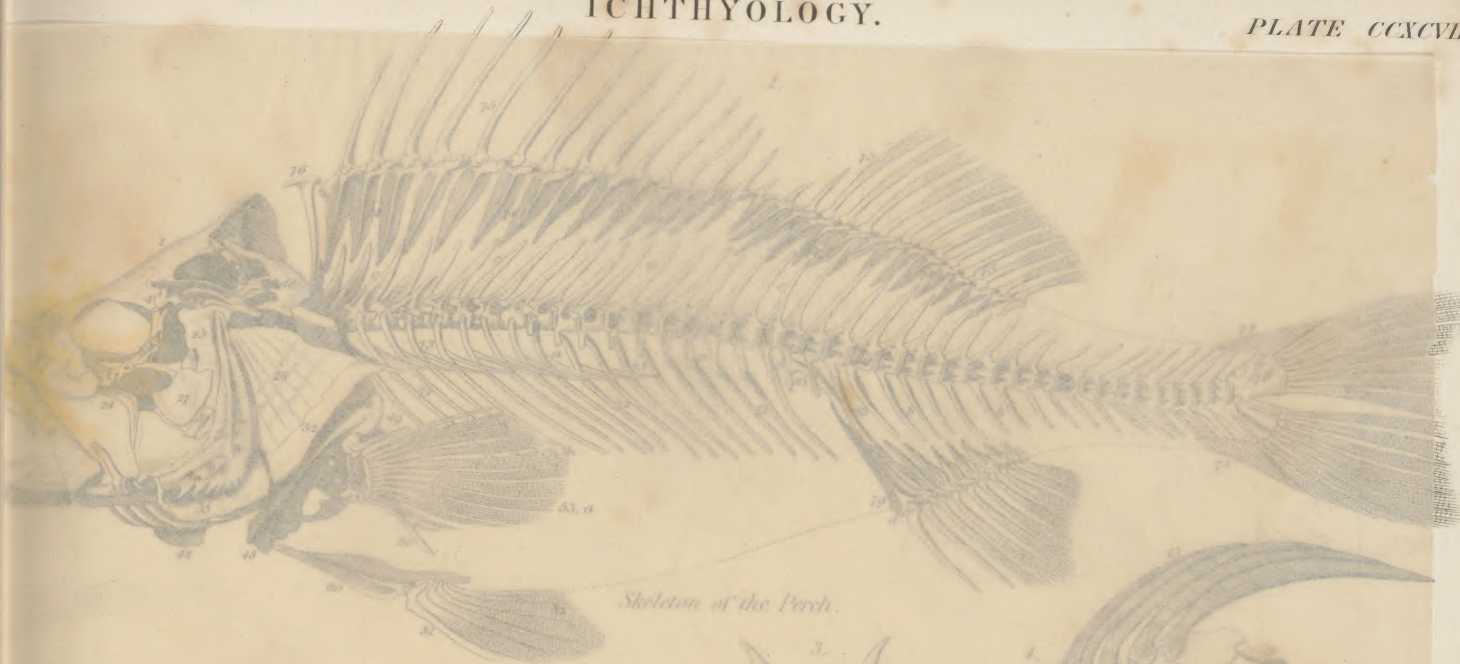
HYGROMETRIC SCALES.



Engd by G. Aikman.

1.



Skeleton of the Perch.

2.

...ranium, &c. of Perch.

3.

Air-bladder of
Corvina trispinosa.

4.

Hyoid bone, branchial
arches, &c. of Perch.

5.

Cranium, branchial rays, &c. of Perch.

6.

Air bladder of
Johnius lobatus.

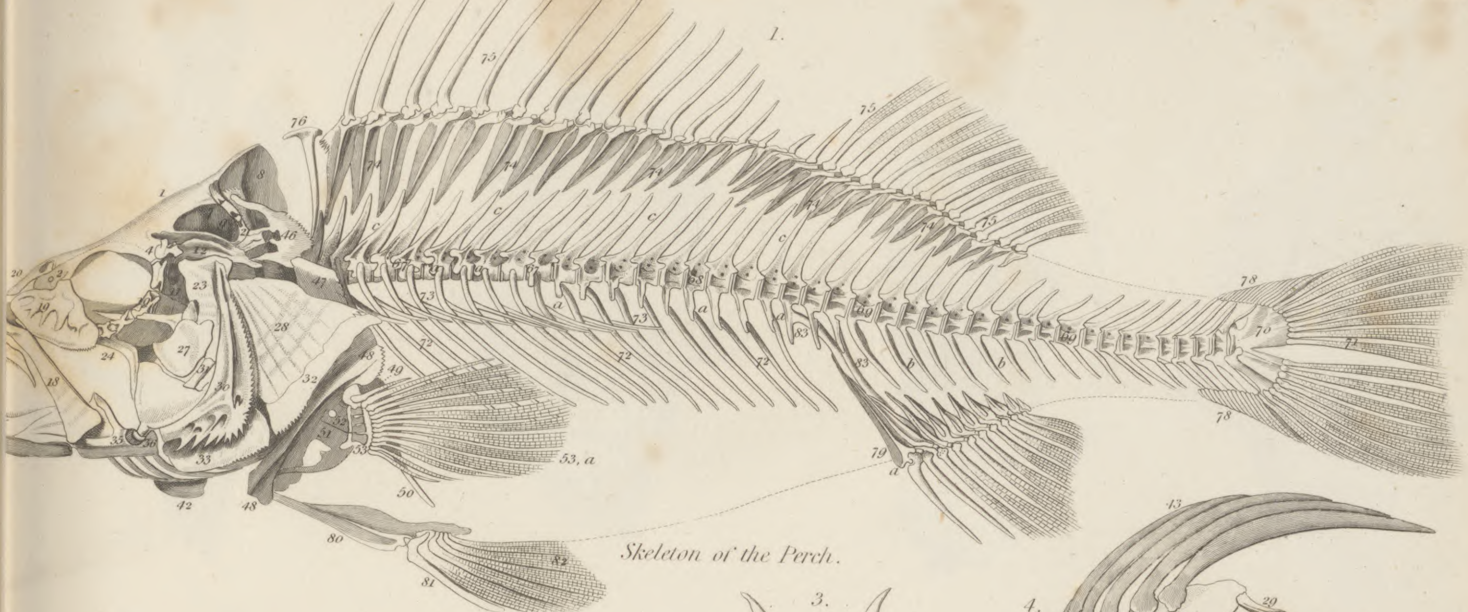
7.

Air-bladder of Pogonias chromis.

8.

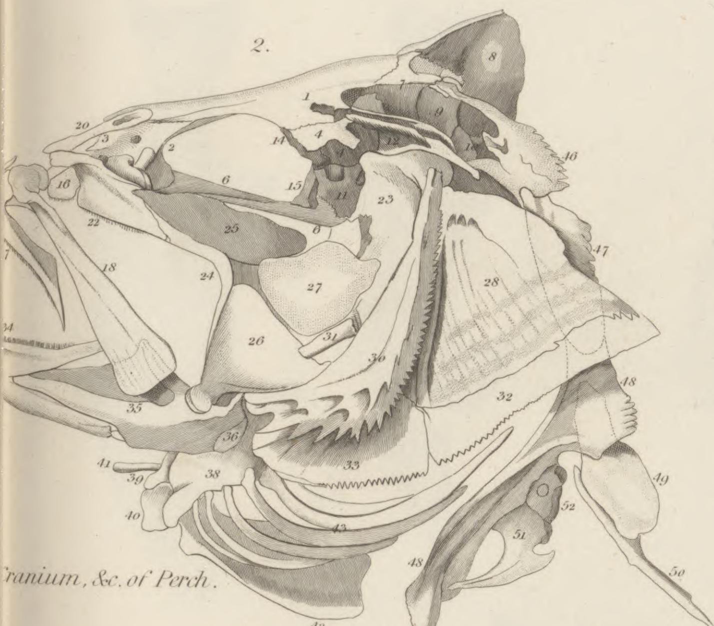
Air bladder of
Johnius [illegible]

1.



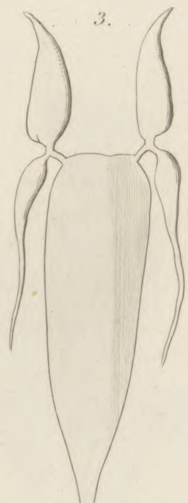
Skeleton of the Perch.

2.



Cranium, &c. of Perch.

3.

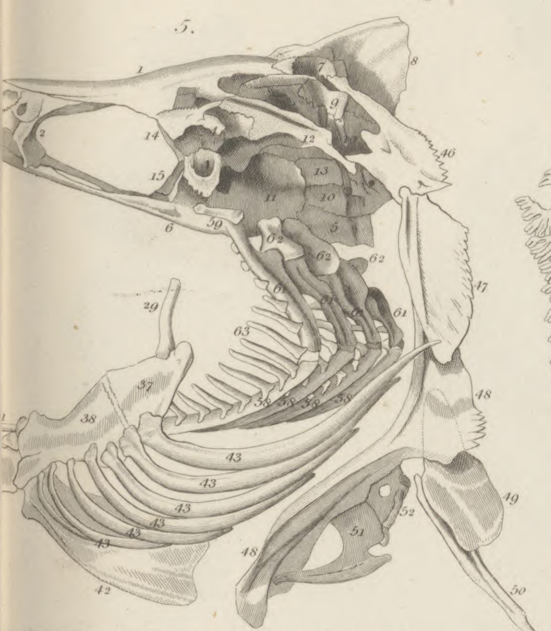


Air-bladder of Corvina trispinosa.

4.

Hyoid bone, branchial arches, &c. of Perch.

5.

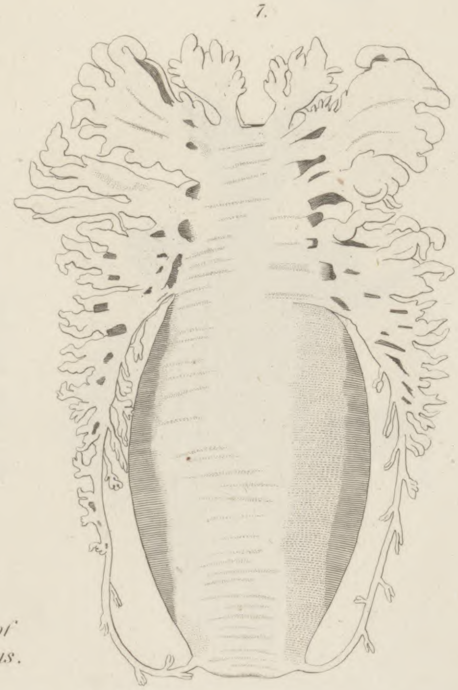


Cranium, branchial rays, &c. of Perch.

6.

Air-bladder of Johnius lobatus.

7.



Air-bladder of Pogonias chromis.

8.

Air bladder of Johnius catalea.

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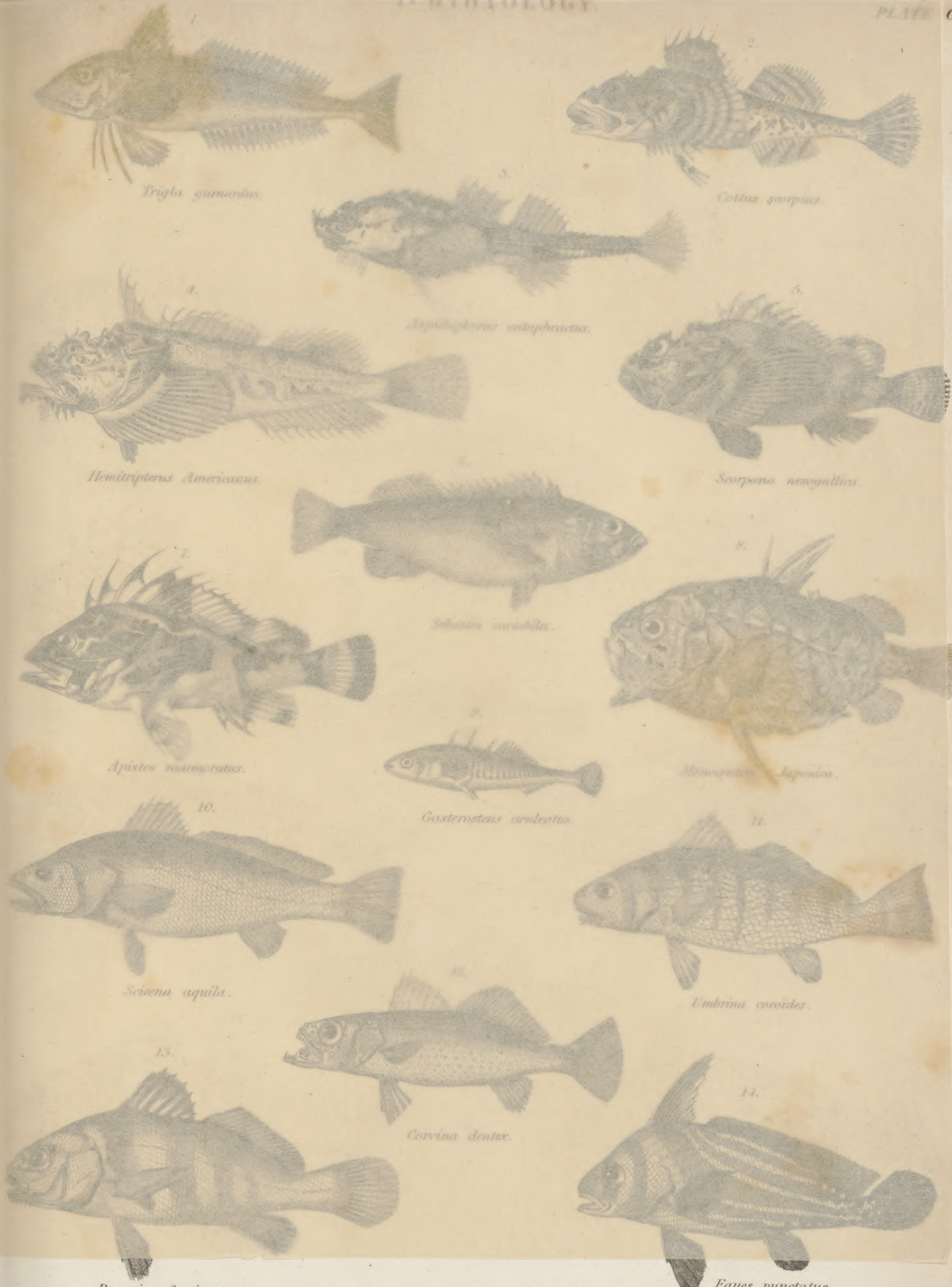
1. Perca fluviatilis.
2. Labrax Lupus.
3. Aspro vulgaris.
4. Serranus altivelis.
5. Mesoprion uninotatus.
6. Pomotis vulgaris.
7. Dules auriga.
8. Holocentrum hastatum.
9. Trachinus radiatus.
10. Uranoscopus inermis.
11. Polynemus quadrifilis.
12. Mullus barbatus.
13. Upeneus Vlamingii.
Engd by G. Aikman.



1. *Trigla gurnardus.*
2. *Cottus scorpius.*
3. *Aspidophorus cataphractus.*
4. *Hemitripterus Americanus.*
5. *Scorpæna newgallia.*
6. *Sebastes variabilis.*
7. *Apistes marmoratus.*
8. *Monocentris Japonica.*
9. *Gasterosteus aculeatus.*
10. *Sciæna aquila.*
11. *Umbrina coroides.*
12. *Corvina dentex.*
13. *Pogonias fasciatus.*
14. *Eques punctatus.*

Engd. by G. Aikman.

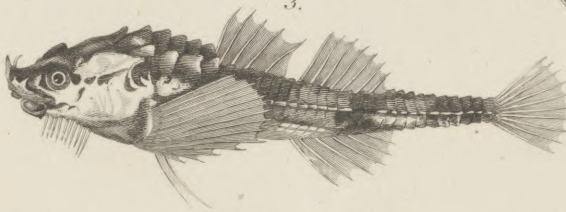
1.

Trigla gurnardus.

2.

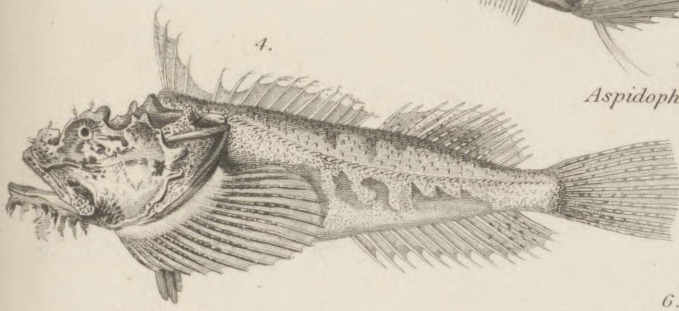
Cottus scorpius.

3.



Aspidophorus cataphractus.

4.

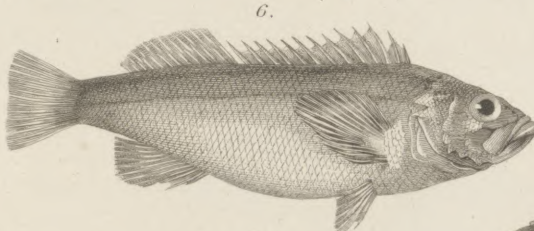


Hemitripterus Americanus.

5.

Scorpæna nesogallica.

6.



Sebastes variabilis.

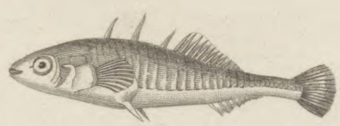
7.

Apistes marmoratus.

8.

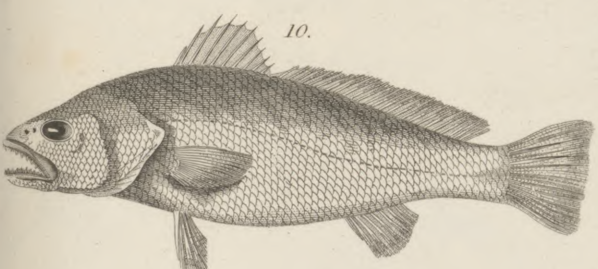
Monocentris Japonica.

9.



Gasterosteus aculeatus.

10.

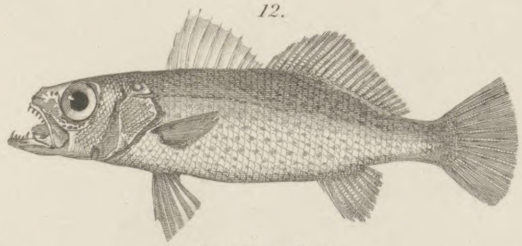


Sciœna aquila.

11.

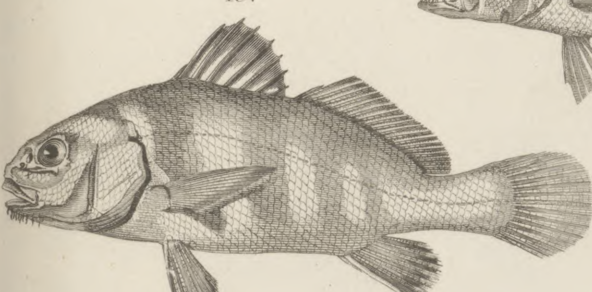
Umbrina coroïdes.

12.



Corvina dentex.

13.



Pogonias fasciatus.

14.

Eques punctatus.

Eng.d by G. Aikman.

Eng.[d] by G. Aikman.

1.

Hæmulon quadrilineatum.

2.

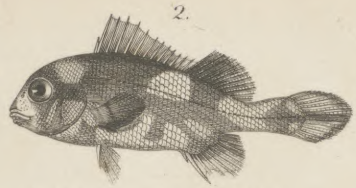
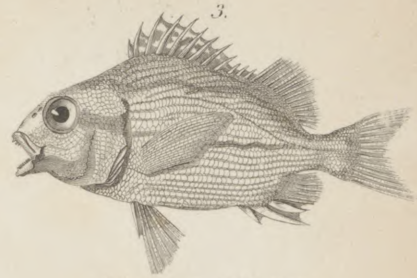


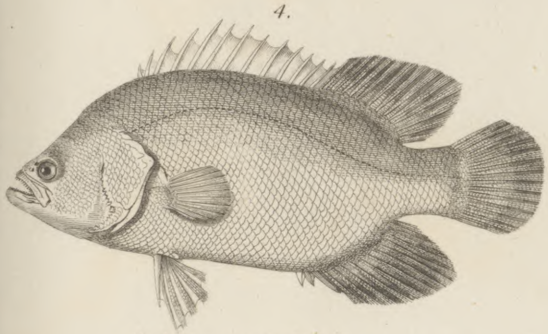
Diagramma orientale.

3.



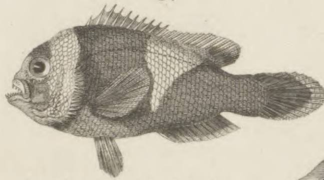
Pristipoma bilineatum.

4.



Lobotes somnolentus.

5.

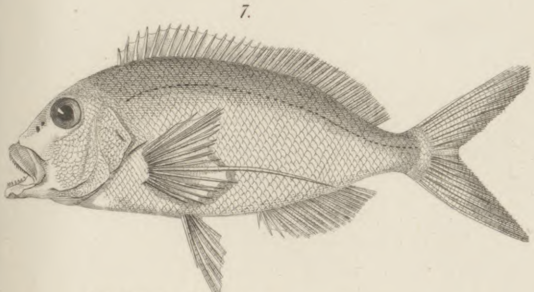


Amphiprion laticlavius.

6.

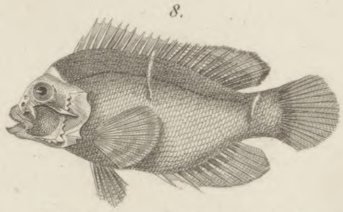
Scolopsides lycogenis.

7.



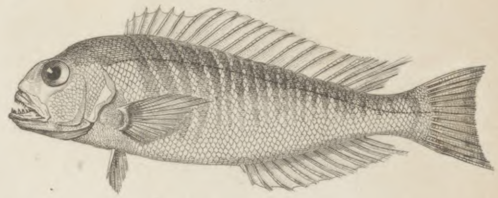
Cheilodactylus carponemus.

8.



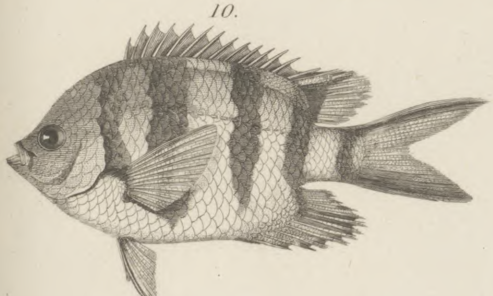
Premnas semicinctus.

9.



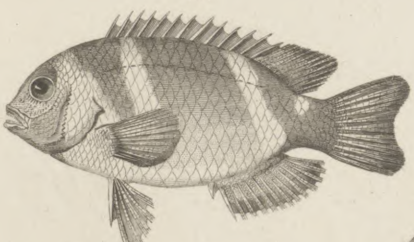
Latilus doliatus.

10.



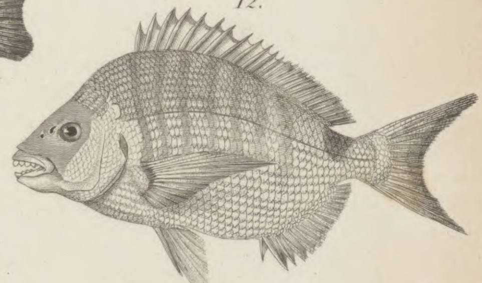
Glyphisodon cœlestinus.

11.



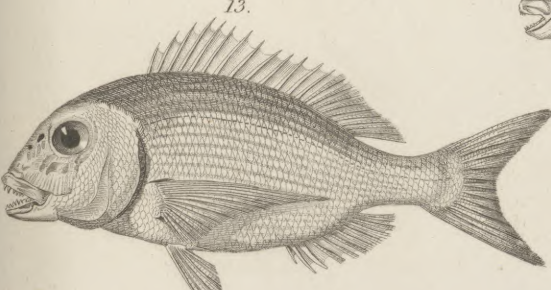
Pomacentrus fasciatus.

12.



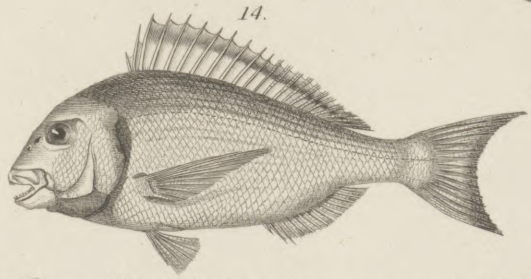
Sargus Rondeletii.

13.



Pagrus vulgaris.

14.



Chrysophrys aurata.

15.

Pagellus erythrinus.

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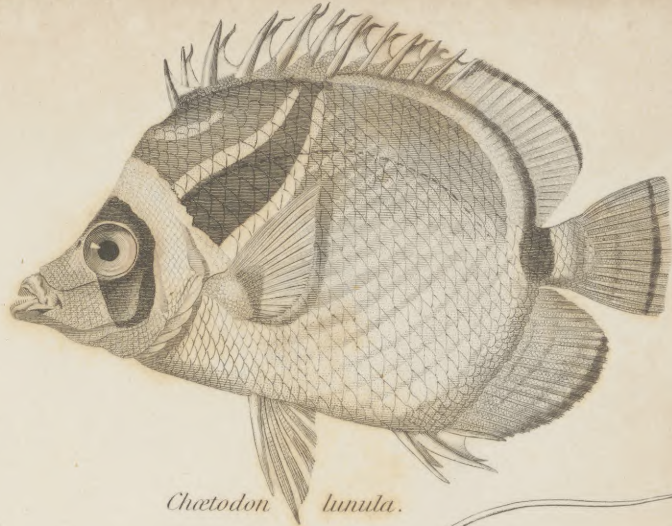
Taurichthys varius. Zanclus cornutus.

Eng^d by G. Aikman.

1.

Chætodon reticulatus.

2.



Chætodon lunula.

3.

Chætodon ephippium.

4.

Heniochus monoceros.

5.

Chelmon longirostris.

6.

Platax teira.

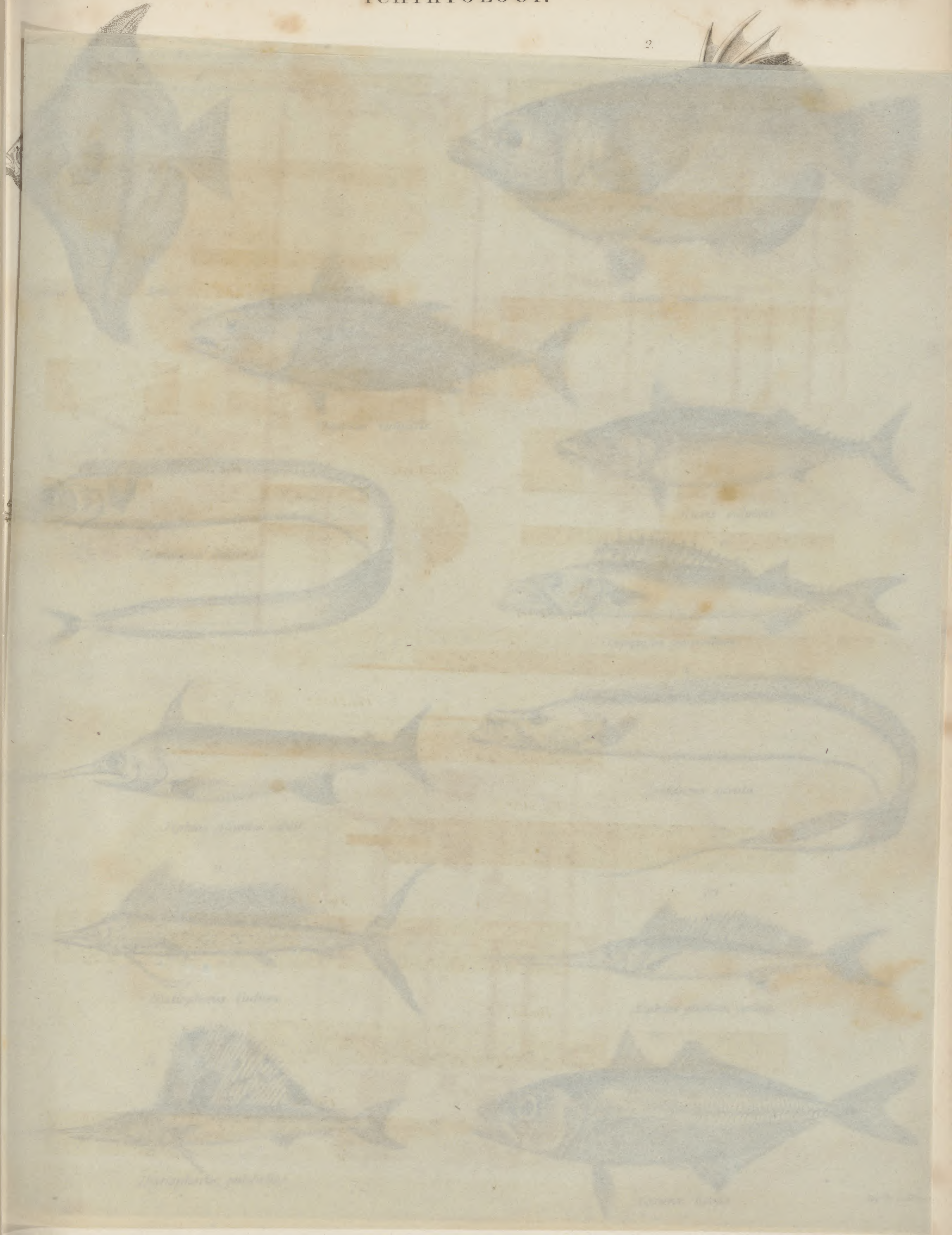
7.

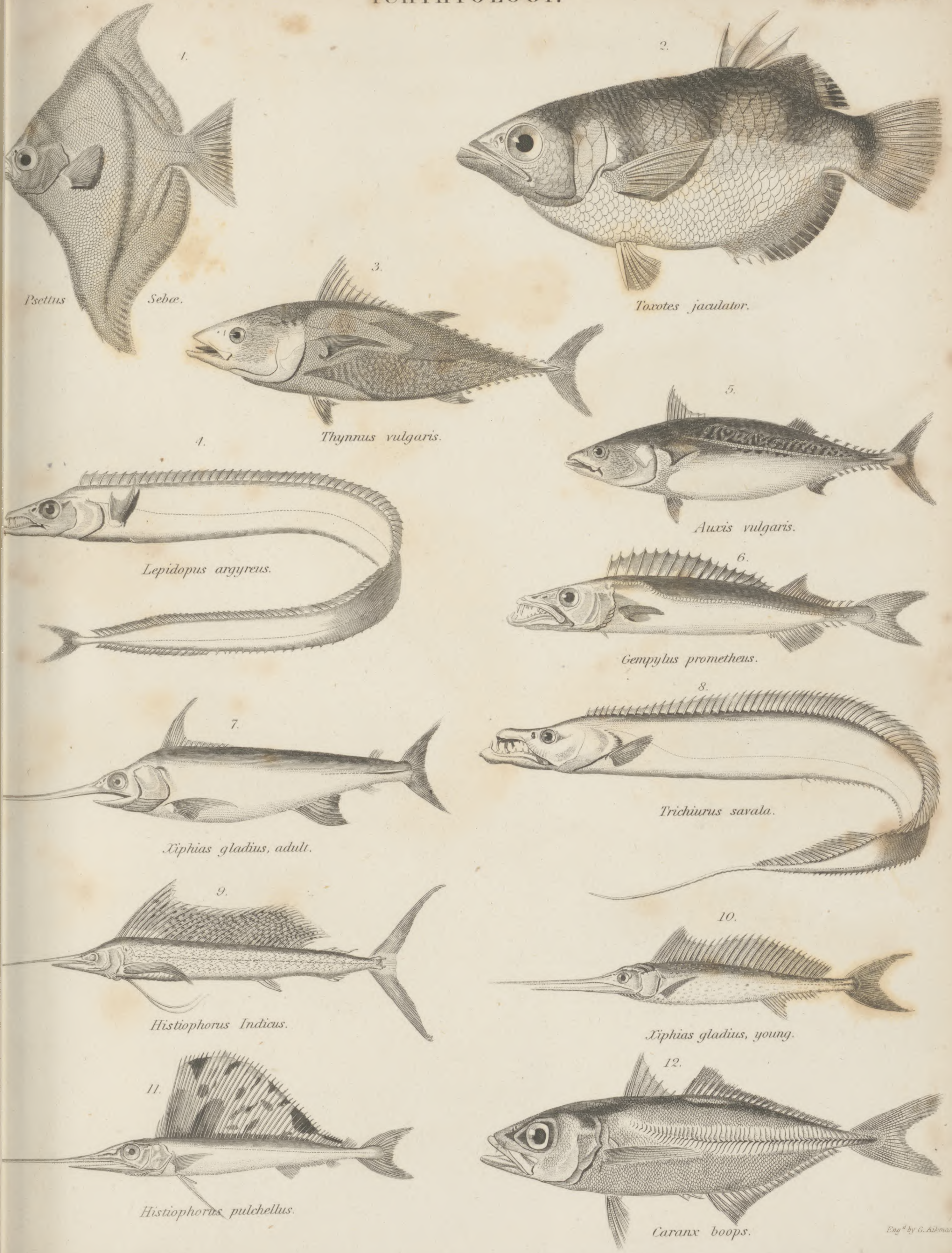
Taurichthys varius.

8.

Zanclus cornutus.

Engd. by G. Aikman.




1.
Psettus Sebæ.
2.
Toxotes jaculator.
3.
Thynnus vulgaris.
4.
Lepidopus argyreus.
5.
Auxis vulgaris.
6.
Gempylus prometheus.
7.
Xiphias gladius, adult.
8.
Trichiurus savala.
9.
Histiophorus Indicus.
10.
Xiphias gladius, young.
11.
Histiophorus pulchellus.
12.
Caranx boops.
Engd by G. Aikman.

Engd by G. Aikman.

1\.

Gallichtys œgyptiacus.

2\.

Coryphæna azorica.

3\.

Pteraclis trichipterus.

4\.

Nomeus Peronii.

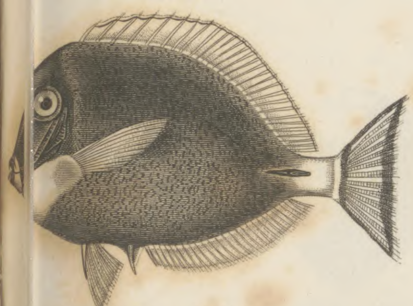
5\.

Zeus faber.

6\.

Lampris guttatus.

7\.

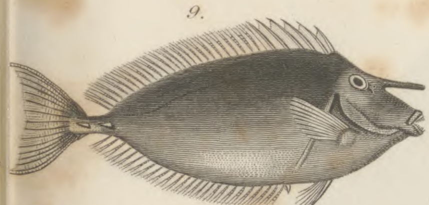


Acanthurus Delisianus.

8\.

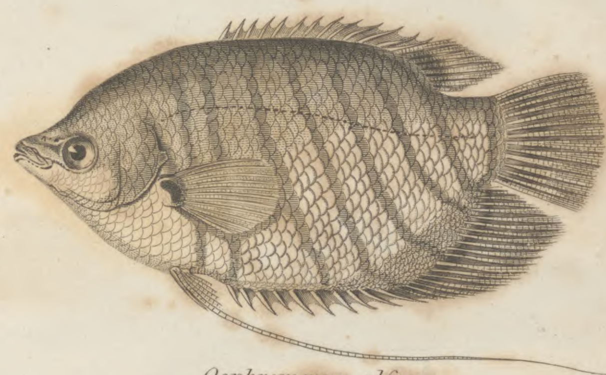
Gymnetrus falx.

9\.



Naseus longicornis.

10\.



Osphromenus olfax.

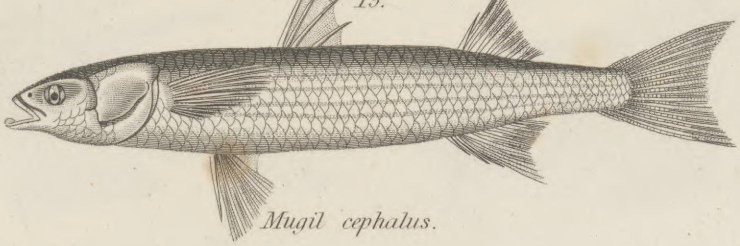
11\.

Anabas scandens.

12\.

Ophicephalus striatus.

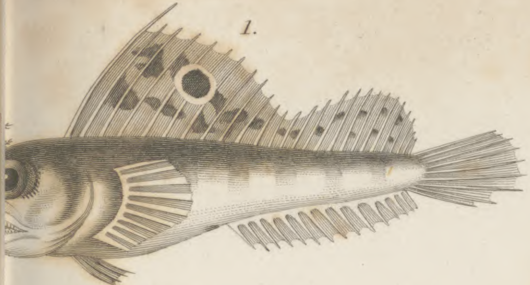
13\.



Mugil cephalus.

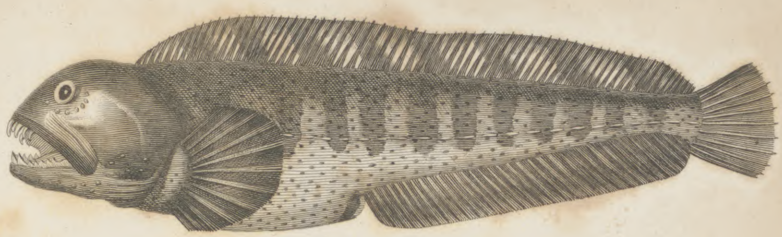
Eng^d by G. Aikman.

1.



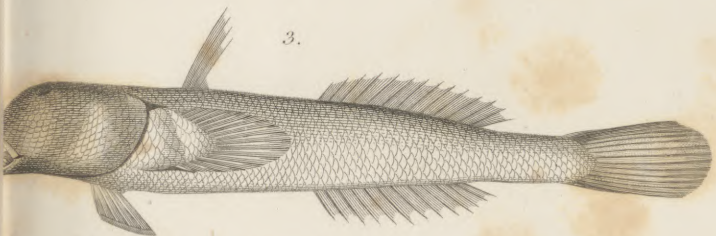
Blennius ocellaris.

2.



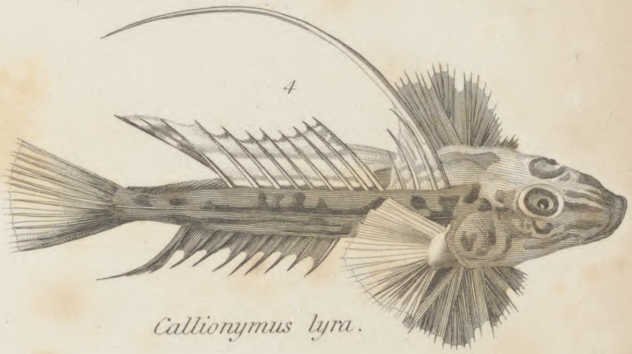
Anarrhichas lupus.

3.



Periopthalmus Freycinetii.

4



Callionymus lyra.

5.

Lophius piscatorius.

6.

Crenilabrus Chabrolii.

7.

Centriscus Scolopax.

8.

Anableps tetropthalmus.

9.

Esox lucius.

10.

Chauliodus Sloani.

11.

Exocetus volitans.

12.

Silurus glanis.

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1. *Salmo Canadensis.*

2. *Alosa vulgaris.*

3. *Polypterus Niloticus.*

4. *Lepisosteus spatula.*

5. *Lota fluviatilis.*

6. *Platessa vulgaris.*

7. *Hippoglossus macrolepidotus.*

8. *Rhombus argus.*

9. *Solea zebra.*

10. *Echeneis naucrates.*

11. *Cyclopterus lumpus.*

Eng.d by G. Aikman.

1.

Salmo Canadensis.

2.

Alosa vulgaris.

3.

Polypterus Niloticus.

4.

Lepisosteus spatula.

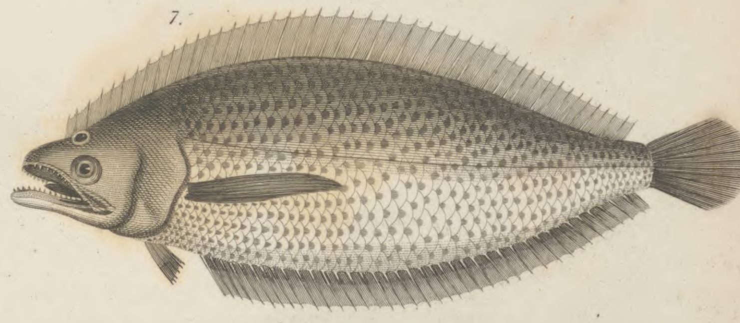
5.

Lota fluviatilis.

6

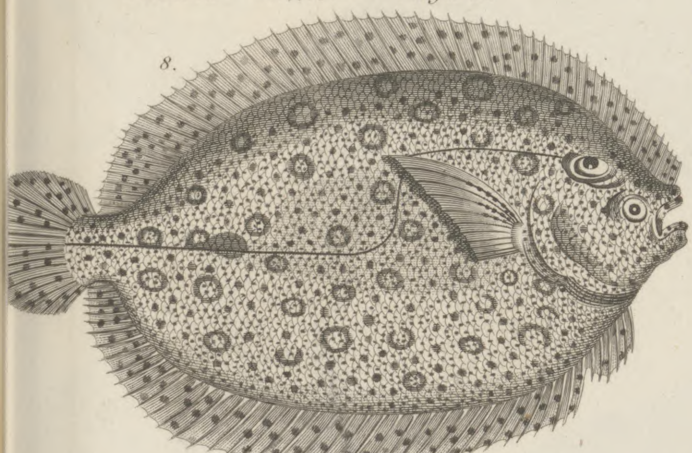
Platessa vulgaris.

7.



Hippoglossus macrolepidotus.

8.



Rhombus argus.

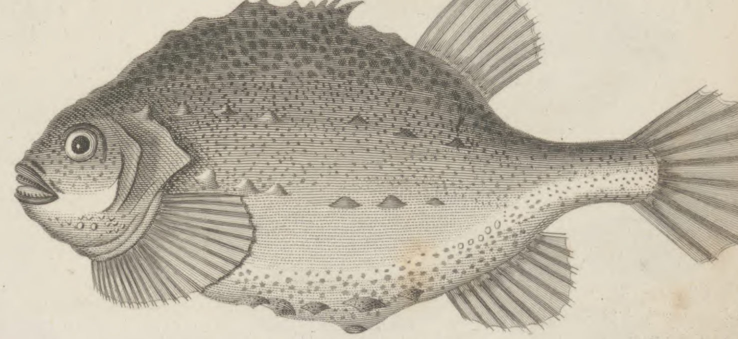
9.

Solea zebra.

10.

Echeneis naucrates.

11.



Cyclopterus lumpus.

Eng^d by G. Aikman.

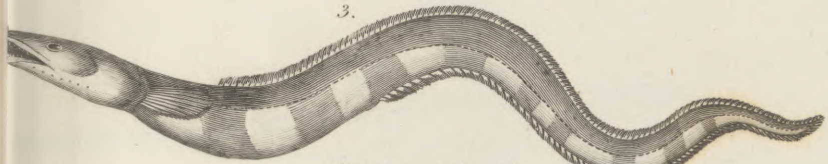
1.

Anguilla vulgaris.

2.

Murœna Helena.

3.



Conger vulgaris.

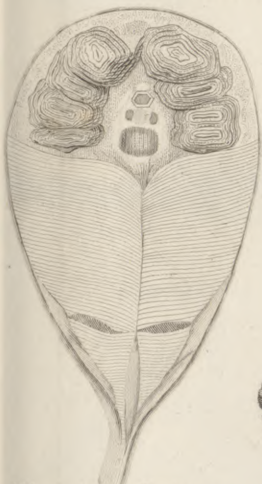
4.

Synbranchus marmoratus.

5.

Gymnotus electricus.

6.

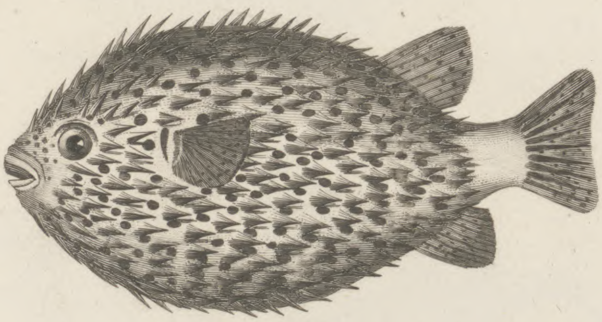


Electric Battery of Gymnotus.

7.

Hippocampus foliatus.

8.



Diodon Atinga.

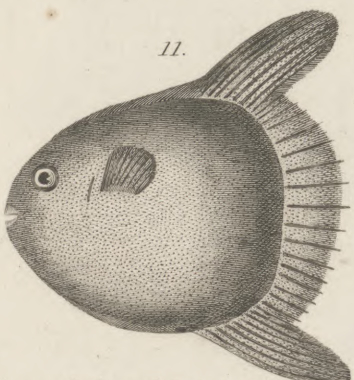
9.

Tetrodon patoca.

10.

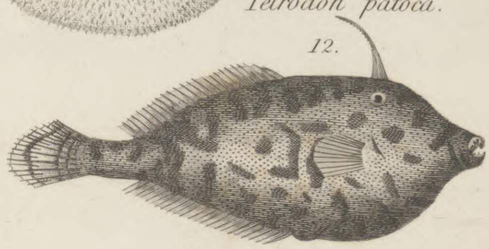
Pegasus draco.

11.



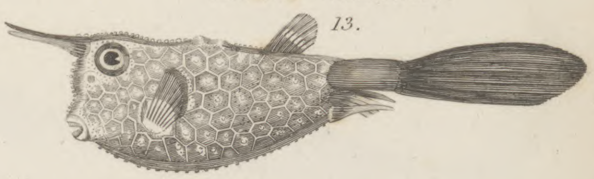
Orthagoriscus mola.

12.



Aluteres monoceros.

13.



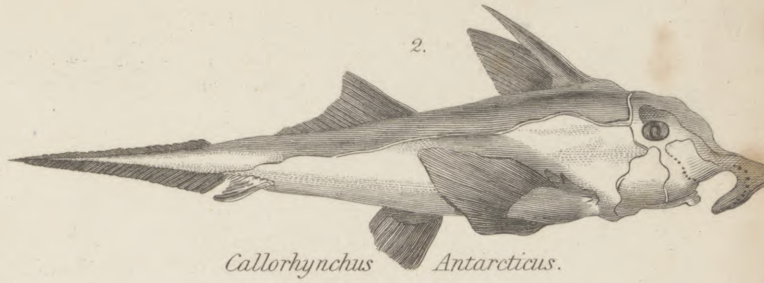
Ostracion cornutus.

Eng.^d by G. Aikman

1.

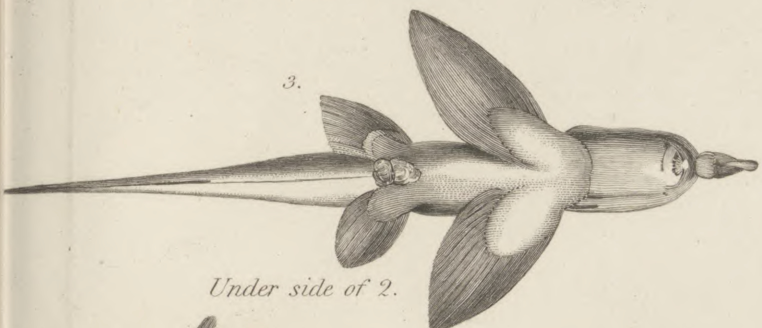
Acipenser Ruthenus.

2.



Callorhynchus Antarcticus.

3.



Under side of 2.

4.

Scyllium fasciatum.

5.

Zygæna Lewenii.

6.

Centrina vulgaris.

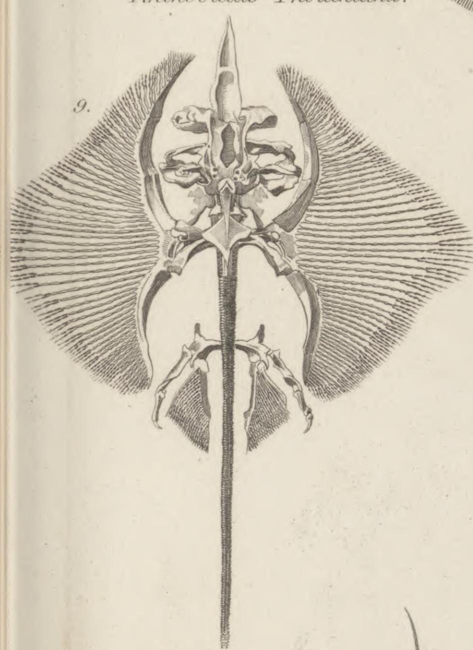
7.

Rhinobatus Thouiniana.

8.

Torpedo Bancroftii.

9.



Skeleton of Raia clavata.

10.

Myliobatis guttata.

11.

Cephaloptera giorna.

12.

Petromyzon marinus, young.

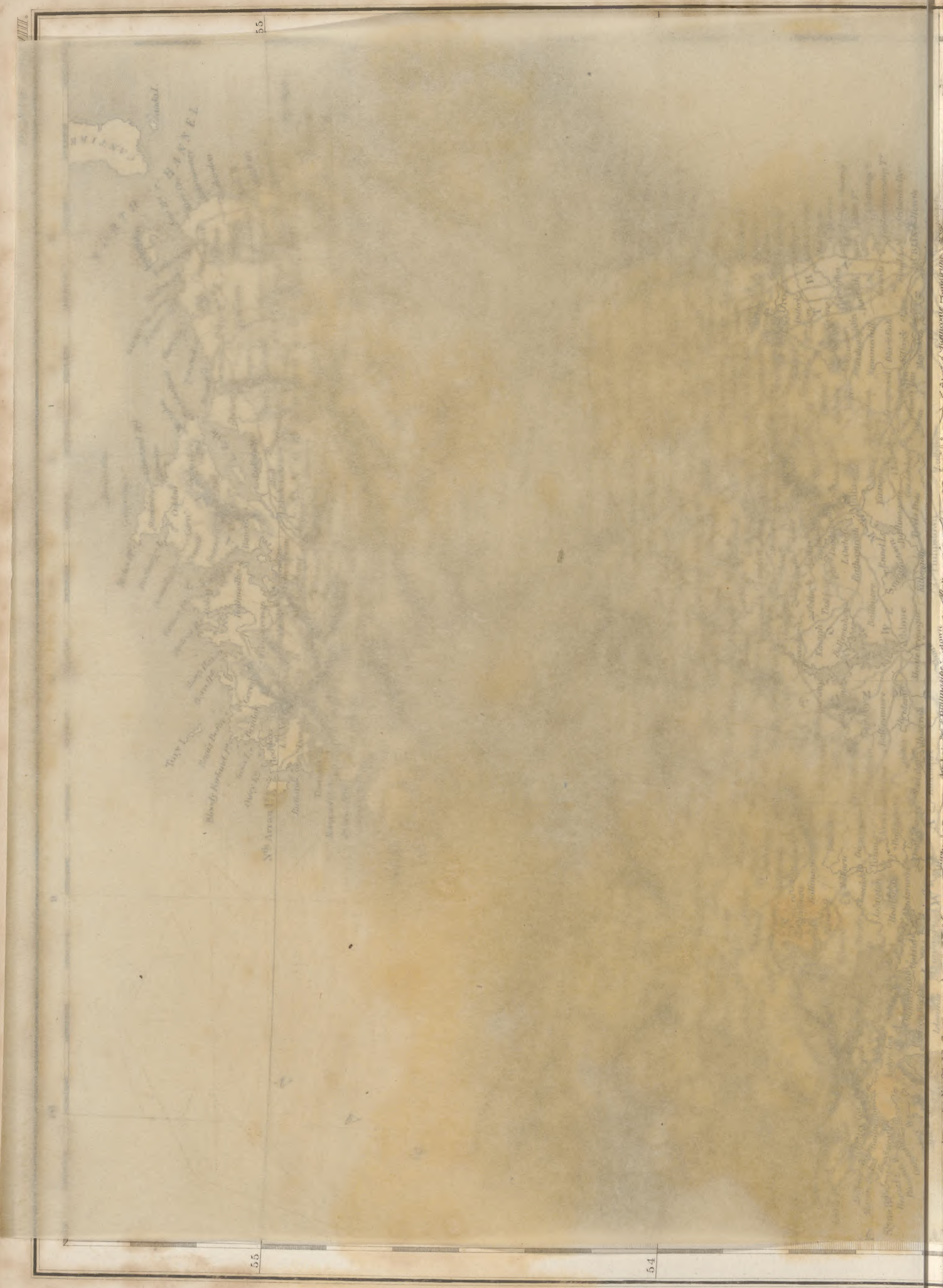
Engᵈ by G. Aikman.


THIBET
CHINA
BIRMAN
SIAM
CAMBOJA
COCHIN CHINA
TONQUIN
YUNNAN
SECHUEN
KOEI TCHEOU
QUANGSI
QUANGTONG
FOKIEN
KIANG SI
HOU QUANG
KIANG NAN
TCHE KIANG
HAINAN
FORMOSA
PHILIPPINE IS
PACIFIC OCEAN
CHINA SEA
BAY OF BENGAL
Martaban Gulf
TONQUIN GULF
Tropic of Cancer
Himalaya Mountains
CANTON
NANKING
AMARAPOURA
RANGOON
BANKOK
MANILA
HUE
KACHAO
Formosa Channel
Paracel Rocks
Macclesfield Bank
Andaman Is
R. Maykiang
R. Irawady
R. Menam
R. Brahmapoutra
R. Ganges
Chusan I.
Ningpo
Shanghai
Amoy
Macao
Dacca
Pegu
Tavoy
Mergui
Siam
Camboja
Tonquin
Hongtse L.
Yangtseu Kiang keou
95
100
105
110
115
120
125
30
25
20
15
10

Engraved by S. Hall, Bury Str.t Bloomsbury.


NORTH CHANNEL
CANTIRE
OCEAN
LONDONDERRY
ARMAGH
SLIGO
Londonderry
Coleraine
Belfast
Lisburn
Antrim
Carrickfergus
Lough Neagh
Omagh
Dungannon
Armagh
Monaghan
Cavan
Enniskillen
L. Erne
Donegal
Donegal Bay
Sligo
Sligo Bay
Killalla Bay
Castlebar
Newport or Clew B.
Westport
Tuam
Boyle
Roscommon
Longford
Athlone
Mullingar
Kells
Navan
Drogheda
Dundalk
Newry
Down Patrick
Dundrum B.
Carlingford B.
Dundalk B.
Dublin
Howth
Broad Haven Har.
Blacksod B.
Achill I.
Achill Hd.
Tory I.
Nth. Arran Is.
L. Swilly
L. Foyle
Raughlin
Giants Causeway
Malin Hd.
Inistrahul
The Maids
Copeland I.
Lambay I.
Tulsk
Granard
Ardee
Strabane
Cookstown
Lough Mask
Red B.
Belfast Lough
55
54
10
9
8
7
6

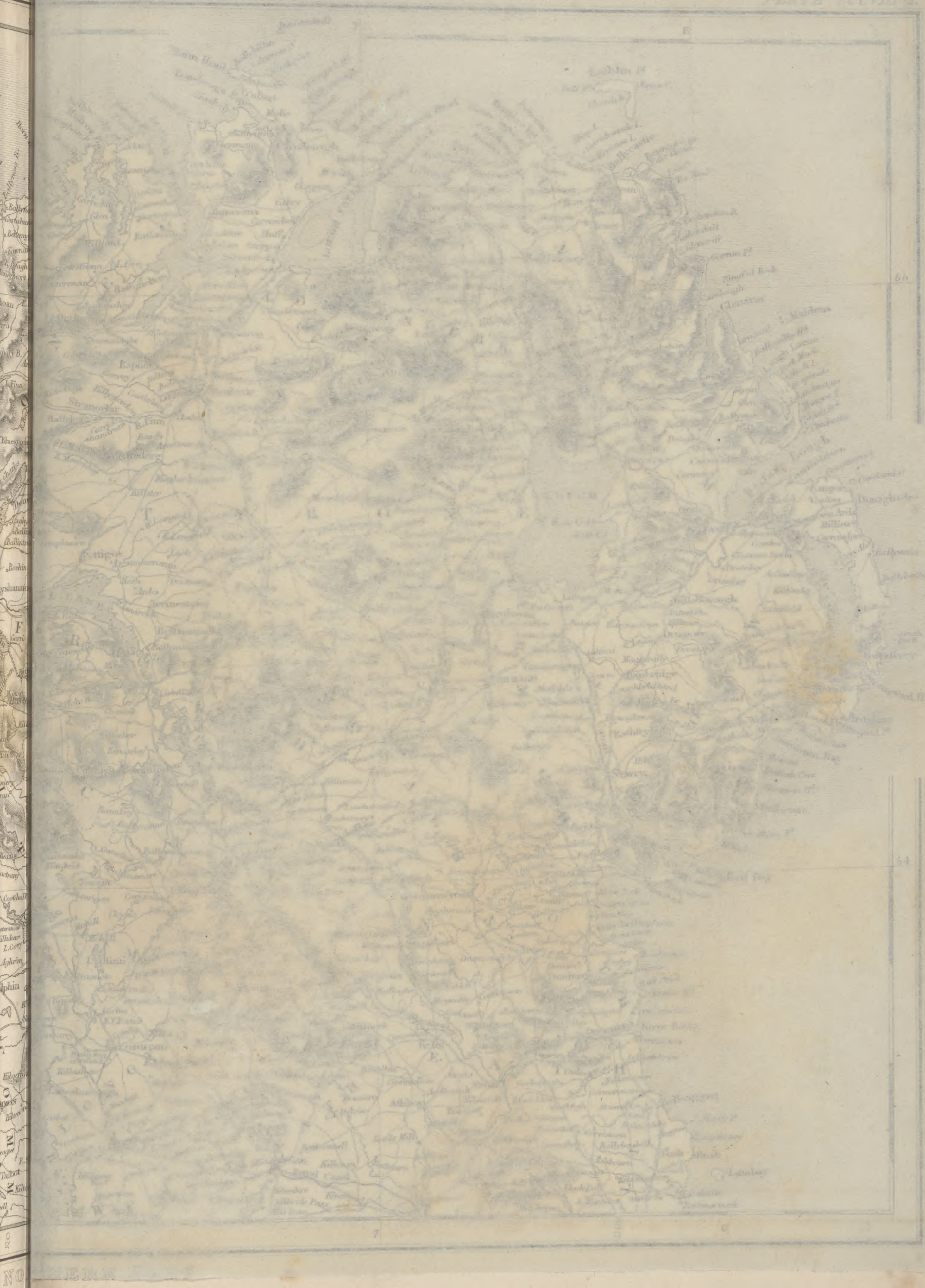

IRELAND.
English Miles.
10 20 30 40 50
53
52
10
9
7
6
Longitude West from Greenwich.
RIVER SHANNON
GALWAY BAY
WICKLOW
Dingle Bay
Bantry Bay
Portarlington
Kildare
Naas
Loughrea
Cork
Mallow
Bantry
Engraved by S. Hall



Engraved by S. Hall, Bury Str.t Bloomsb.y


IRELAND.
English Miles
5 10 20 30
10
9
55
54
Tory I.
Tor More
Innisbeg
Innisdoey
Innisboffin
Bloody Foreland
Innisherg
Gola Is.
Gweedore Bay
Owey I.
Cruit I.
Aranmore I.
Rutland
Innisiree
Maghery
Dunglow
L. Anure
Glendoan
Roaninnish
Inniskeel
Dawros Hd.
Loughrussmore B.
Loughrusbeg B.
Tormore I.
M. Ballard
Glen Columbkill
Rossan Pt.
Malinbeg
Malinmore
Rathlin O Birne I.
Slievh League
Carrigan Hd.
Teelin B.
Killybegs
Kilcar
Naran
Maas
Ardara
Glenties
Bluestack
Fintragh B.
Killybegs Harbour
Point St. John
Inver B.
DONEGAL BAY
Mount Charles
Rossnowlagh
Kildoney
R. Erne
Ballyshannon
Bundoran
Tullaghan
Boabinshi Rs.
Clossibawn
Innismurray
Milk haven
Ahamplish
Grange
Knocklane Pt.
SLIGO BAY
Aughris Hd.
SLIGO
Knockarea
L. Gill
Dromore
Ardnaglass
Skreen
Easky
Cabragh
Killglass
Inniscroan
Scurramore
Castleconner
Kilalla
Ballisakerry
Rossirk
Ardagh
Ballina
Killala Bay
Kilcummin Hd.
Benwee Hd.
Broad Haven
Erris Hd.
Eagle I.
Belmullet
Innis Glora
Innis Keeragh
North Inniskea
South Inniskea
Tarmon
Duvillaun I.
Black Rk.
Binghamstown
Blacksod B.
Bangor
L. Carrowmore
Crossmolina
L. Conn
M. Nephin
Croghan M.
Achil Hd.
Keem B.
Dooagh
ACHIL
The Bills
Achil Sound
Achil Beg
Curraun Achil
Burrishoole
Newport
CLEW BAY
Claggan
Westport
Clare I.
Clare Hd.
Innisturk
Innisdalla
Innisbofin
Innishark
Killery H.
Friars
Omey I.
Crua
Tarbert I.
Ardbear or Clifden B.
Clifden
Twelve Pins
Joyces Country
Connemara
Leenane
Cong
L. Mask
L. CORRIB
CASTLEBAR
Foxford
Swineford
Ballyvary
Balla
Ballyhaunis
Kilkelly
Kilmovee
Claremorris
Ballinrobe
Hollymount
Headford
Tuam
Dunmore
Ballinlough
Castlerea
Loughglinn
Frenchpark
Boyle
Elphin
Ballymote
Tubbercurry
Collooney
Ballisadare
L. Arrow
L. Gara
Ballaghadereen
ROSCOMMON
Athleague
Mount Talbot
Brideswell
Ballygar
Glenamaddy
Creggs
Ballinamore
N.T. Bellew
Mt. Bellew

IRELAND, NO


Stranorlar
Bluestack
Glenarm
Donaghadee
Newry
Athboy
Lambay

Aghrim
Killuken
Elphin

Innistrahull
Malin Head
Trawbeaga Bay
Rathlin Id
Bull Pt
Bruce C.
Church B.
Bengore Hd
Giants Causeway
Dunseverick C.
Fair Head
Tor Head
Carndonagh
Moville
Inishowen Head
Magilligan Pt & T.
Port Rush
Bushmills
Ballycastle
Coleraine
Buncrana
Rathmullen
Ballymoney
Cushendun B.
Cushendall
Garron Pt
Ringfad Rock
Carnlough
Glenarm
Maidens
Letterkenny
LONDONDERRY
Limavady
Dungiven
Garvagh
Kilrea
Portglenone
Ballymena
Larne
Lough Larne
Magee I.
Black Hd
Raphoe
Lifford
Strabane
Stranorlar
Maghera
Magherafelt
Randalstown
ANTRIM
Carrickfergus
Belfast Lough
Copeland Pt
Bangor
Donaghadee
Castlederg
N.T. Stewart
Cookstown
LOUGH NEAGH
BELFAST
Newtown Ards
Ballywater
Ballyhalbert
L. Derg
OMAGH
Pettigoe
Dungannon
Lisburn
Lurgan
Moira
Hillsborough
L. ERNE
Irvinestown
Fintona
Ballygawley
Charlemont
Portadown
Dromore
Ballynahinch
Portaferry
South Rock
Clogher
Aughnacloy
Tanderagee
Banbridge
ENNISKILLEN
ARMAGH
Markethill
DOWNPATRICK
Strangford Hr
Ardglass
Killough
Ringfad Pt
Glaslough
Rathfryland
Castle Wellan
Dundrum Bay
MONAGHAN
Keady
Newry
Newry Canal
Dunmore Hd
Mullartown
Lee Stone Pt
Kilkeel
Swanlinbar
Newtown Butler
Castle Blaney
Carlingford
Carlingford Bay
Belturbet
Cootehill
DUNDALK
Templetown
CAVAN
Carrickmacross
Castle Bellingham
Ballyborough
Ardee
Dunleer
Port Oriel
Clogher Hd
Virginia
L. Sheelin
L. Ramor
Collon
Termonfeckin
Granard
DROGHEDA
River Boyne
Slane
LONGFORD
Edgeworthtown
Kells
Navan
Duleek
Castle Pollard
Balbriggan
Skerry Is
Athboy
TRIM
Lanesborough
Loughshiney
Rush
Lusk
Lambay
MULLINGAR
Royal Canal
Malahide
Portmarnock
Swords
Dunboyne
Longwood
Kinnegad
55
54
7
6

THERN PART.


10
9
8
53
Slyne Hd.
Roundstone B.
Bertirbuy B.
Cashel
Kilkerran B.
Iarconnaught
GALWAY
Costello F.P.
Invrin Cas.
Spiddle F.P.
Barna F.P.
GALWAY BAY
Isles of Arran
Arranmore
Inisheer
Innismain
Killany B.
Branach
Thur Lough
Knock F.
L. Ross
Monivea
Athenry
Newcastle
Castle Blakeney
Menlough
Ballymacward
Killconnel
Ballinasloe
New Inn
Aughrim
Loughrea
Crawell
Kilcolgan
Kinvarra
Ardrahan
Killinan
Kilcriest
Eyrecourt
Lawrencetown
Portumna
Woodford
Leitrim
Tynagh
Ladyswell
Killimore
Ballindery
N.T. Daly
Ballyvaghane B.
Newport Quay
Back Hd.
R. Fanore
Rathbourny
Kilmacduagh
Gort
Ballyturn
L. Cooter
Derrybrian
Tobberdony
Doolin
Killdagh
Noohyde
Kilfenora
Corrofin
Inchiquin
L. Tadon
Dromore
Hags Hd.
Liscanor Bay
Innistymon
Spanish Pt.
Enniskerry I.
Dunbeg B.
Killard Hd.
Ballard Hd.
Kilkee B.
Kilkee
Dunbeg
Kilmurry
Kilmaley
Dysart
Drumkleeve
ENNIS
Clare
Quin Abbey
Tulloch
Tomgrany
L. Graney
Scarriff
Lough Derg
Killaloe
Ballina
Broadford
Bridgetown
L. Clogmelea
Newmarket
Bunratty
Mediak
Truugh
Parteen
LIMERICK
Annacotty
Newport
Copper Mines
Keeper M.
Silvermines
Templederry
Toomevara
Abane
Abington
Doon
Cappamore
Kilrush
Moyferta
Kilballihone
Loop Head
Scattery I.
Carrigafoyle I.
Tarbert
Glin
Foynes I.
Loghill
Ballyhahill
Shanagolden
Askeaton
Pallas Kenry
Mungret
Patricks Well
Fort Union
Adare
Croagh
Rathkeale
Croom
Fellamore
Caherconlish
Pallasgreen
Killeely
Bruff
Elmly
Tipperary
Knocklong
RIVER SHANNON
Kilkadrane P.
Asdea
Ballybunian
Ballylongford
Newtownsands
Listowel
Ardagh
Newcastle
Ballingarry
Knockadirry
Athlacca
Bulgaden
Bruree
Killmallock
Galbally
Galtee
Kerry Hd.
Ballyheigh
Ballyduff
Abbeyfeale
Ardfert
Tralee B.
TRALEE
Brandon Bay
Brandon Hd.
M. Brandon
Smerwick Hr.
Dunmore Hd.
Blasquets
Ferriter Cas.
Sybil Hd.
Ballinrasha
Smerwick
Ventry
Dingle
Dingle Hr.
Ventry Hr.
DINGLE BAY
Lispole
Castlemain
Castle Island
Inch
K. Wills Tn.
Knockanure
Brown Flesk R.
Currans
Scartaglin
Milltown
Killorglin
Rossbeigh
Aghagarry
Listry
Killarney
Muckross
Glenflesk
Blackstones
Magilicuddy's Reeks
Caragh
Kanglass Hd.
Doulus Hd.
Valentia Harbour
Valentia
Cahirciveen
Iveragh Mts.
Brea Hd.
Port Magee
Puffin
Killimly
Skelligs
Bolus Hd.
Ballinskelligs B.
L. Currane
Waterville
Coad
Sneem
Kenmare
KENMARE RIVER
Kilgarvan
Ballyvourny
Macroom
Muskerry Ms.
Inchygeelagh
Glanerought Ms.
Bantry
Whiddy
Dunmanway
Bear I.
Bear Haven
BANTRY BAY
Sheep Hd.
Dunmanus Bay
Threecastle Hd.
Mizen Hd.
Barley Cove
Crookhaven
Skull
Baltimore
Cape Clear
Castletownsend
Skibbereen
Rosscarbery
Glandore Hr.
Clonakilty
Clonakilty B.
Courtmacsherry Bay
Seven Heads
Old Head of Kinsale
Kinsale
Kinsale Harbour
Oyster Hr.
Bandon
Ballymoney
Innishannon
Dromolegue
Dunbollog
Cork Harbour
Cove
Carrigaline
Passage
CORK
Blarney
Ballincollig
Middleton
Cloyne
Castlemartyr
Poor Hd.
Dungourney
Mallow
Fermoy
Kilworth
Mitchelstown
Doneraile
Buttevant
Kanturk
Newmarket
Charleville
Millstreet
Dromagh
Paps
Bograh Ms.
Donoughmore
Watergrasshill
Rathcormack
Kilshannig
Liscarrol
Churchtown
Castletown Roche
Ballyhooly
Knockacappul
Inchbeg
Millstreet
Aghabalog
K
E
R
R
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C
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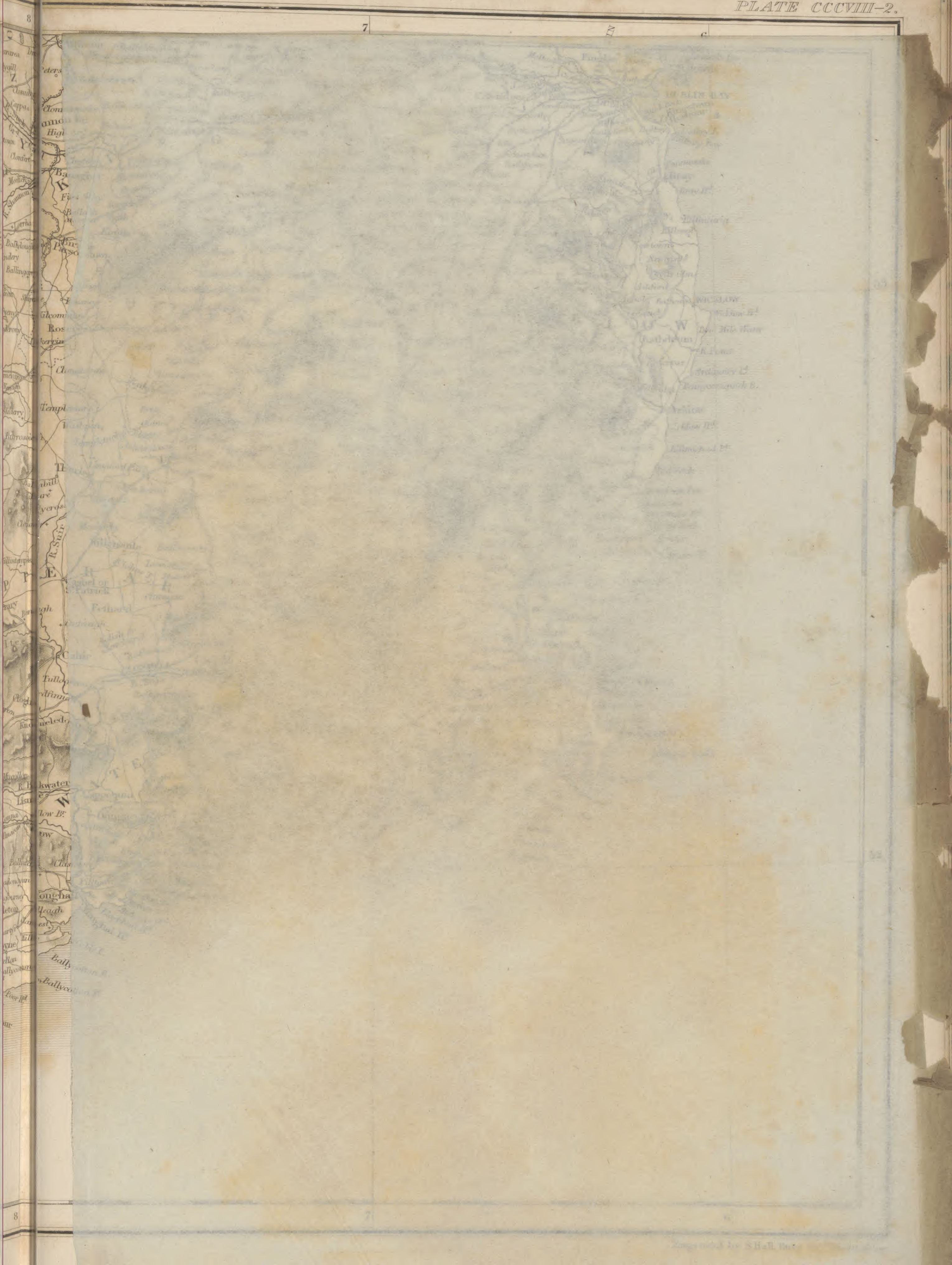
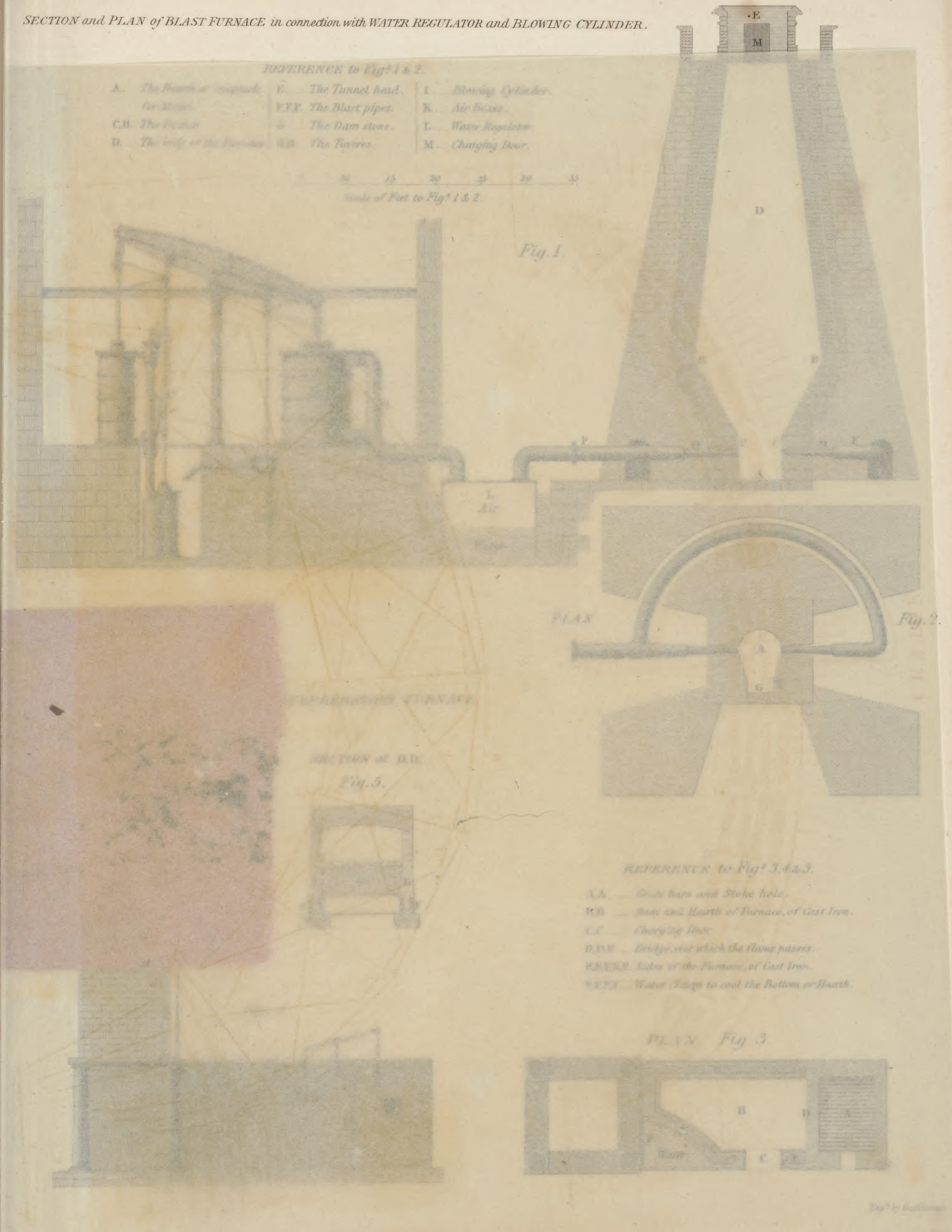


Engraved by S. Hall. Bury Str.t Bloomsbury.

SECTION and PLAN of BLAST FURNACE in connection with WATER REGULATOR and BLOWING CYLINDER.



SECTION and PLAN of BLAST FURNACE in connection with WATER REGULATOR and BLOWING CYLINDER.

REFERENCE to Figs 1 & 2.

A. The Hearth, or receptacle for Metal.
C,B. The Boshes.
D. The body of the Furnace.
E. The Tunnel head.
F,F,F. The Blast pipes.
G. The Dam stone.
H,H. The Tuyeres.
I. Blowing Cylinder.
K. Air Boxes.
L. Water Regulator.
M. Charging Door.

5 10 15 20 25 30 35
Scale of Feet to Figs 1 & 2.

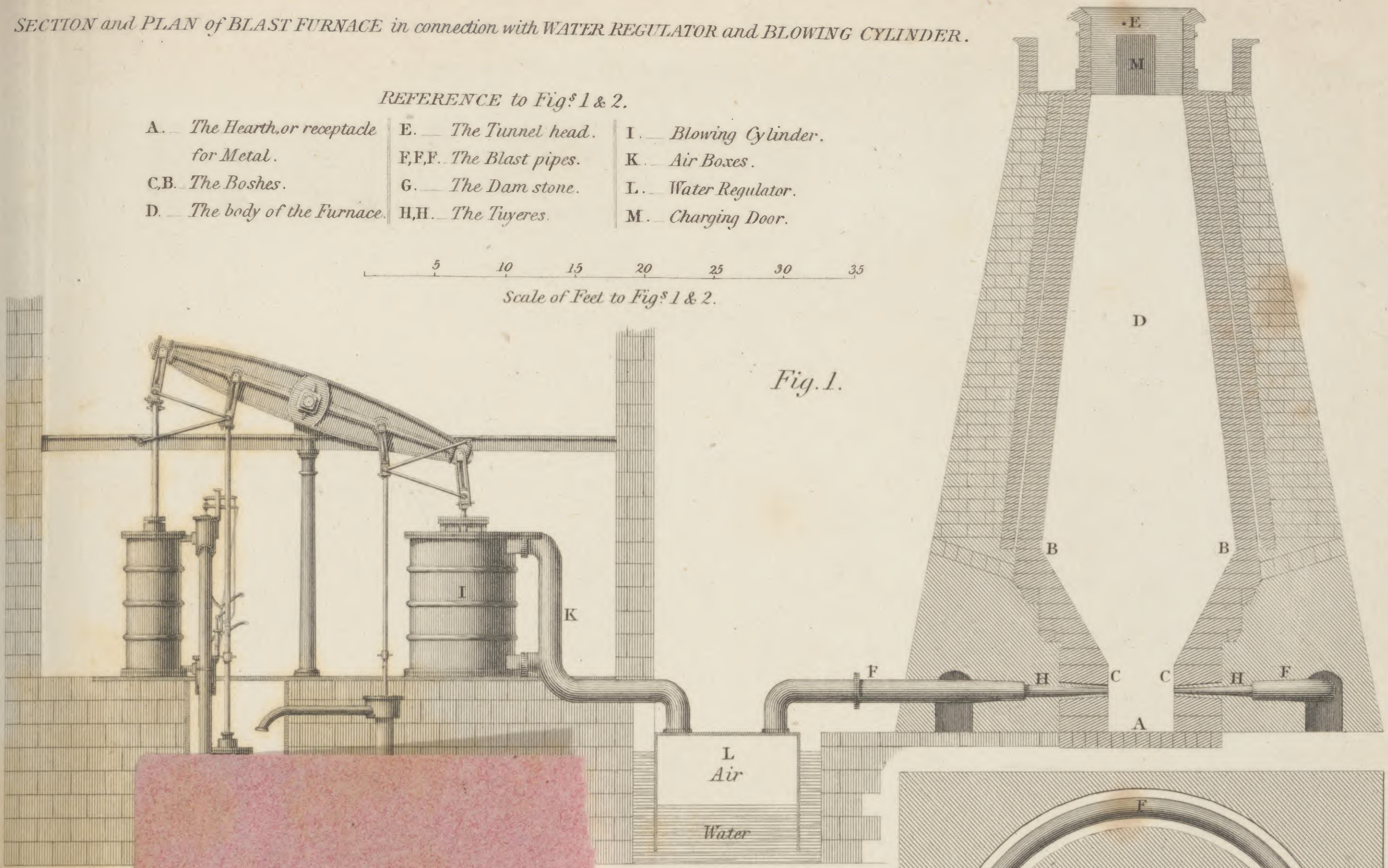
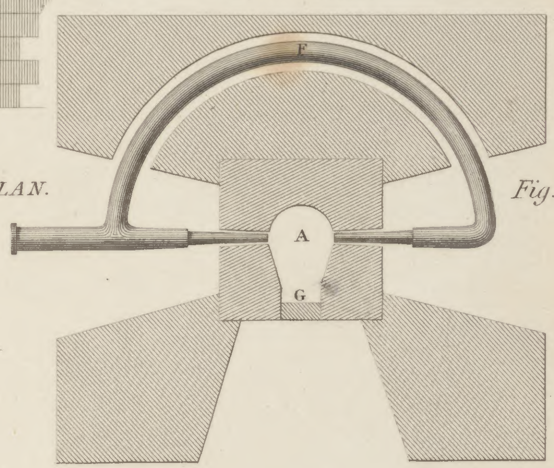


Fig. 1.



PLAN. Fig. 2.

Y FURNACE.

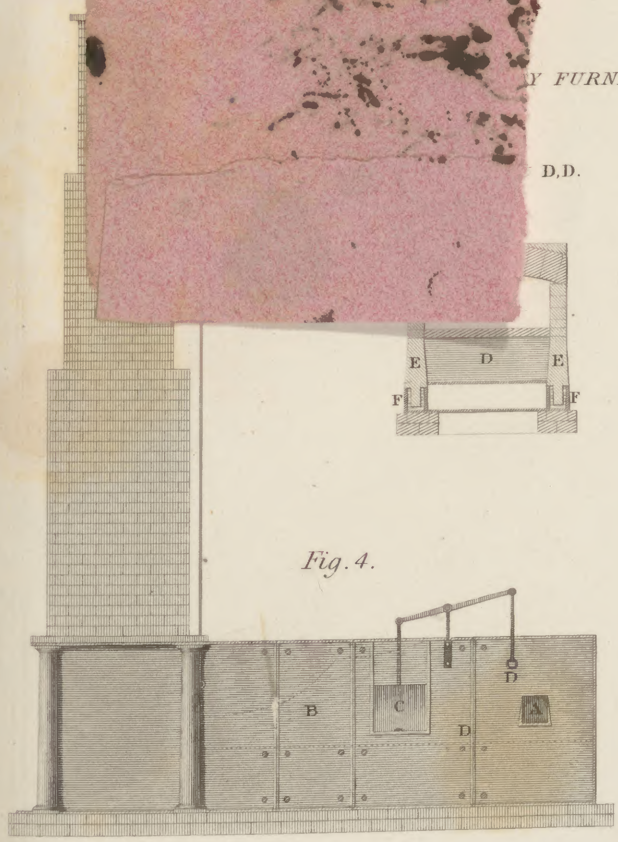
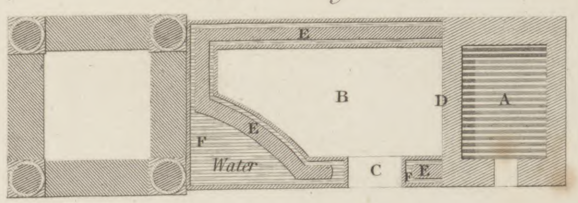


Fig. 4.

REFERENCE to Figs 3. 4 & 5.

A,A. Grate bars and Stoke hole.
B,B. Body and Hearth of Furnace, of Cast Iron.
C,C. Charging Door.
D,D,D. Bridge, over which the flame passes.
E,E,E,E,E. Sides of the Furnace, of Cast Iron.
F,F,F,F. Water Cistern to cool the Bottom or Hearth.

PLAN. Fig. 3.



Engd by G. Aikman.

SECTION and PLAN of BLAST FURNACE in connection with WATER REGULATOR and BLOWING CYLINDER.

REFERENCE to Figs 1 & 2.

A. _ *The Hearth, or receptacle for Metal.*	E. _ *The Tunnel head.*	I. _ *Blowing Cylinder.*
C,B. _ *The Boshes.*	F,F,F. _ *The Blast pipes.*	K. _ *Air Boxes.*
D. _ *The body of the Furnace.*	G. _ *The Dam stone.*	L. _ *Water Regulator.*
	H,H. _ *The Tuyeres.*	M. _ *Charging Door.*

5 10 15 20 25 30 35

Scale of Feet to Figs 1 & 2.

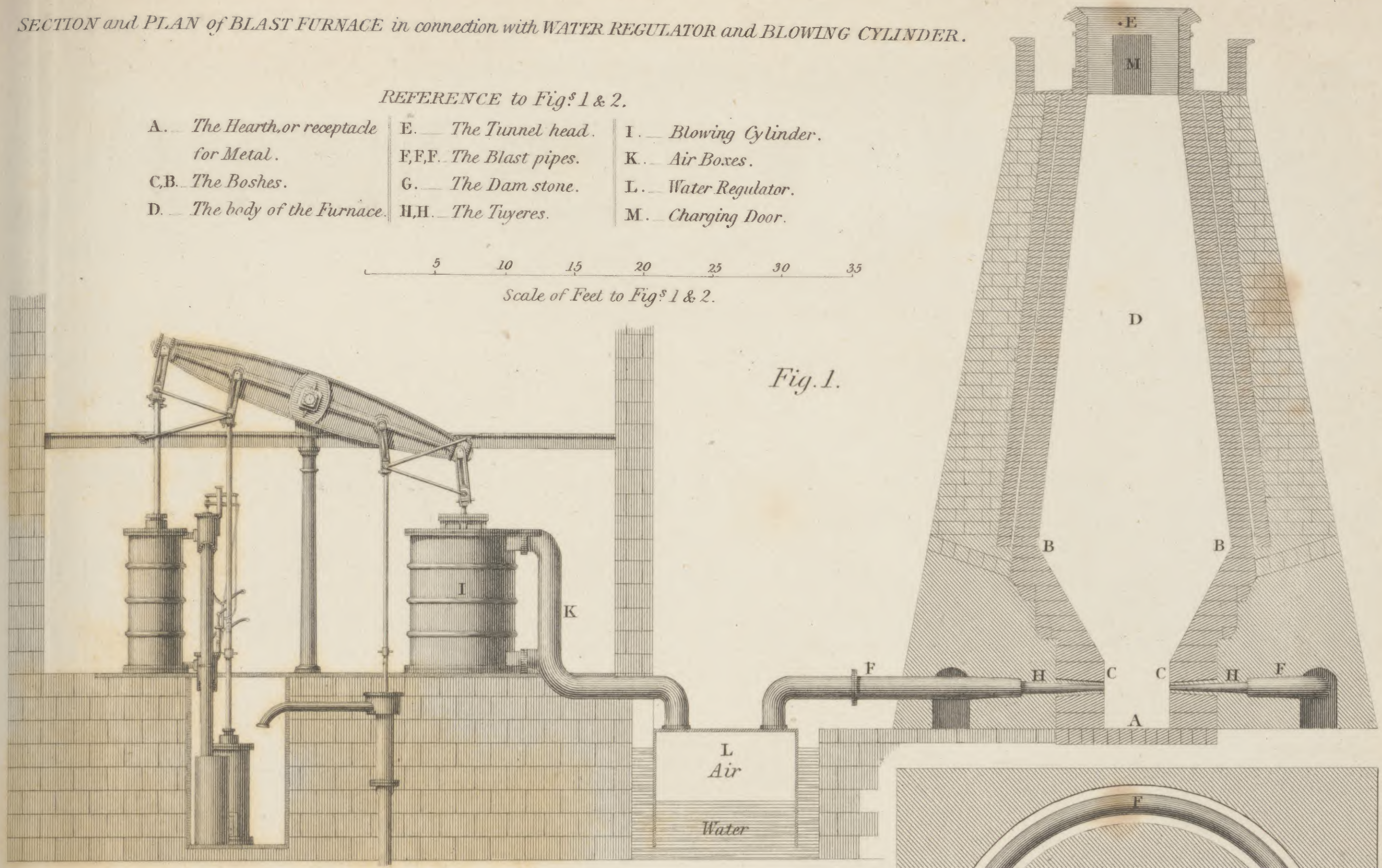
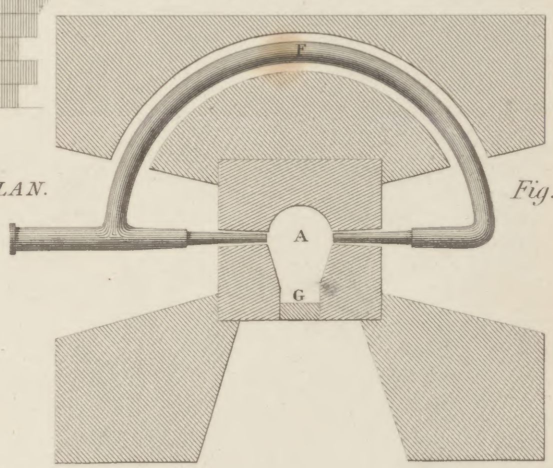


Fig. 1.



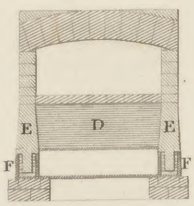
PLAN. *Fig. 2.*

ELEVATION.

REVERBERATORY FURNACE.

SECTION at D,D.

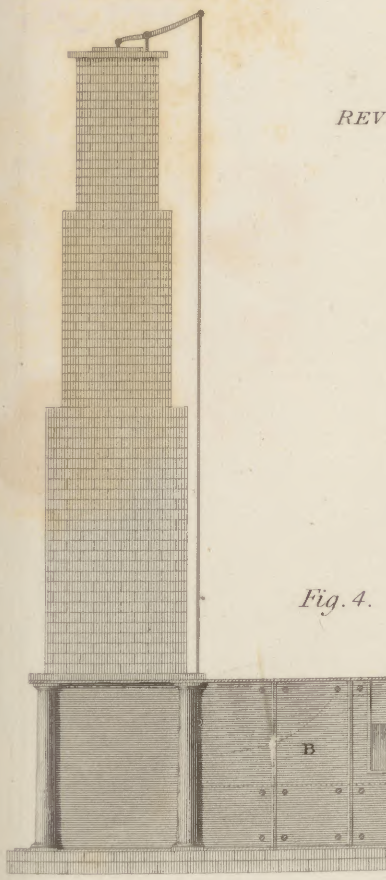
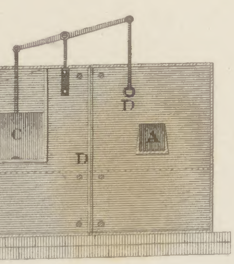
Fig. 5.



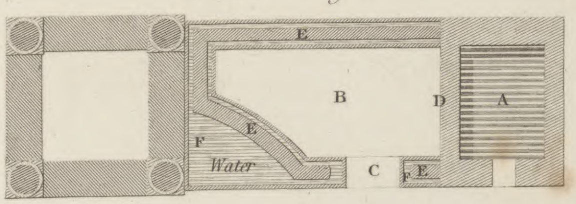
REFERENCE to Figs 3.4 & 5.

A,A. _ *Grate bars and Stoke hole.*
B,B. _ *Body and Hearth of Furnace, of Cast Iron.*
C,C. _ *Charging Door.*
D,D,D. _ *Bridge, over which the flame passes.*
E,E,E,E,E. *Sides of the Furnace, of Cast Iron.*
F,F,F,F. _ *Water Cistern to cool the Bottom or Hearth.*

Fig. 4.

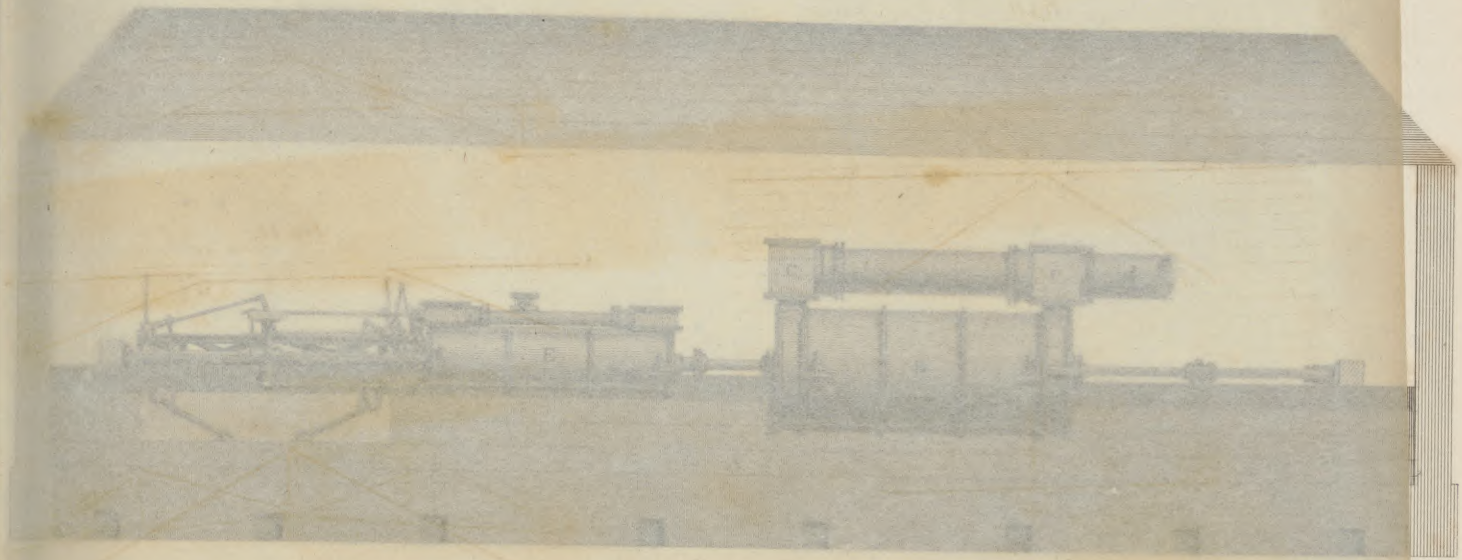
PLAN. Fig. 3.



Engd by G. Aikman.

BLAST ENGINE, Erected at Wylam Iron Works, by R.& W. HAWTHON, Civil Engineers, NEWCASTLE upon TYNE.

ELEVATION. Fig. 1.



CROSS SECTION.

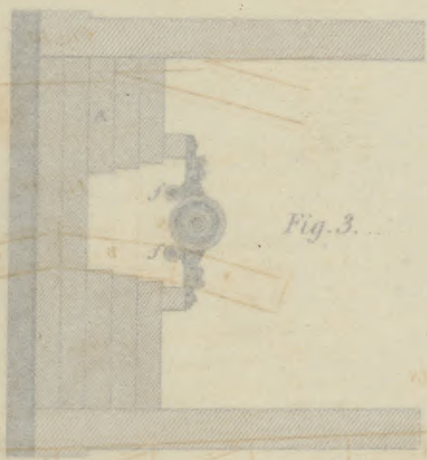


Fig. 3.

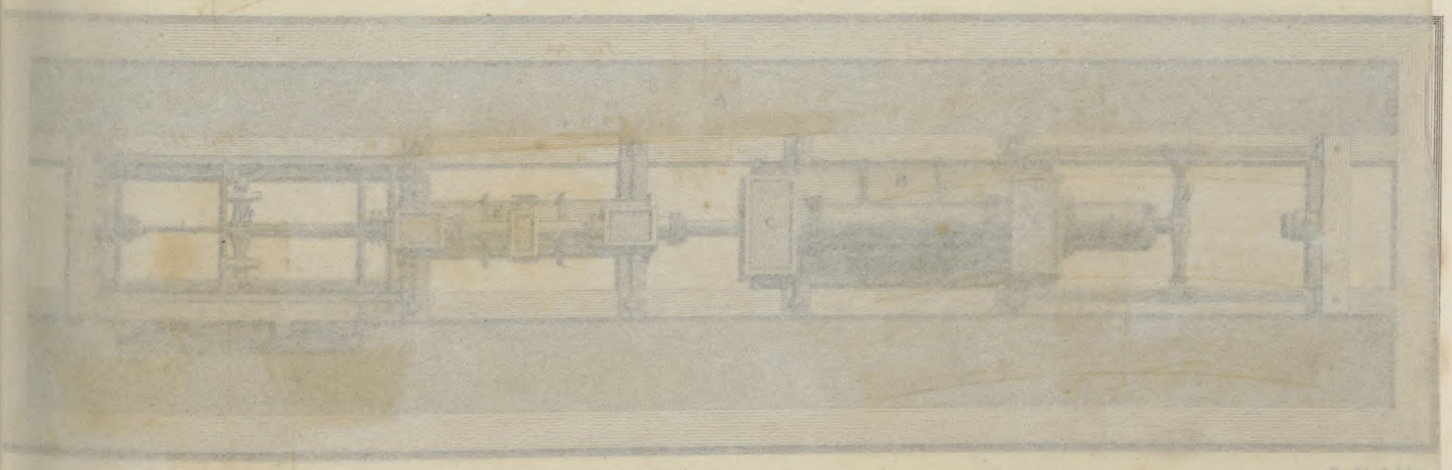
REFERENCE.

A.A. Represents the Pillar on which the Engine is fixed.
B.B. The Blast Cylinder.
C.C. The Wind Boxes in which are fixed the discharging valves.
d.d. The Blast Pipe leading to the Furnaces.
E.E. The Steam Cylinder.
f.f. The Force Pumps.
g.g. The Hand or Working Gear.
h.h. The Cross heads.
i.i.i.i. The Slides for guiding the Piston Rods.
k.k. The Banging Boxes.

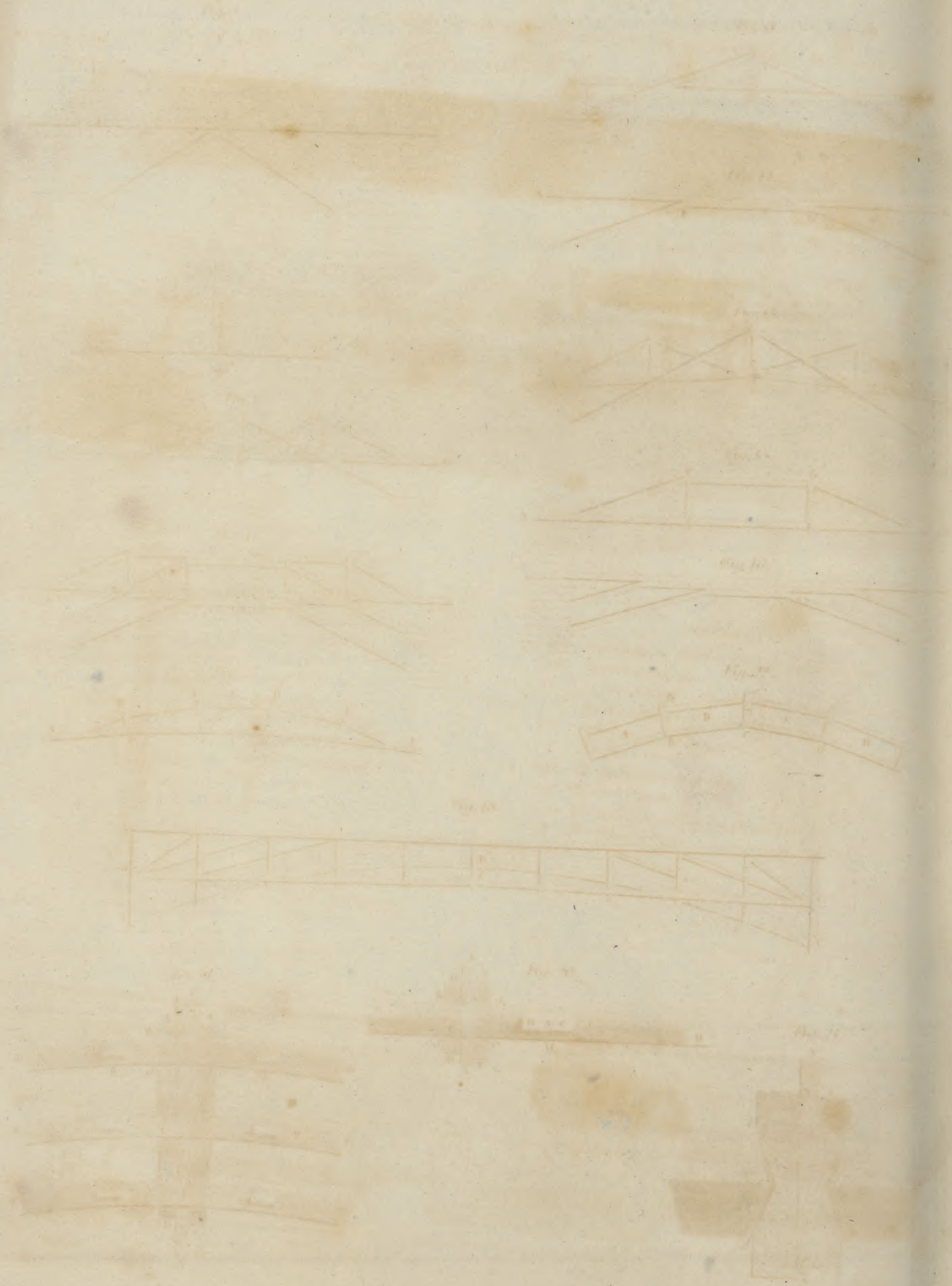
SCALE.

0 5 10 15 20 Feet.

PLAN. Fig. 2.



Engd by C. Adams

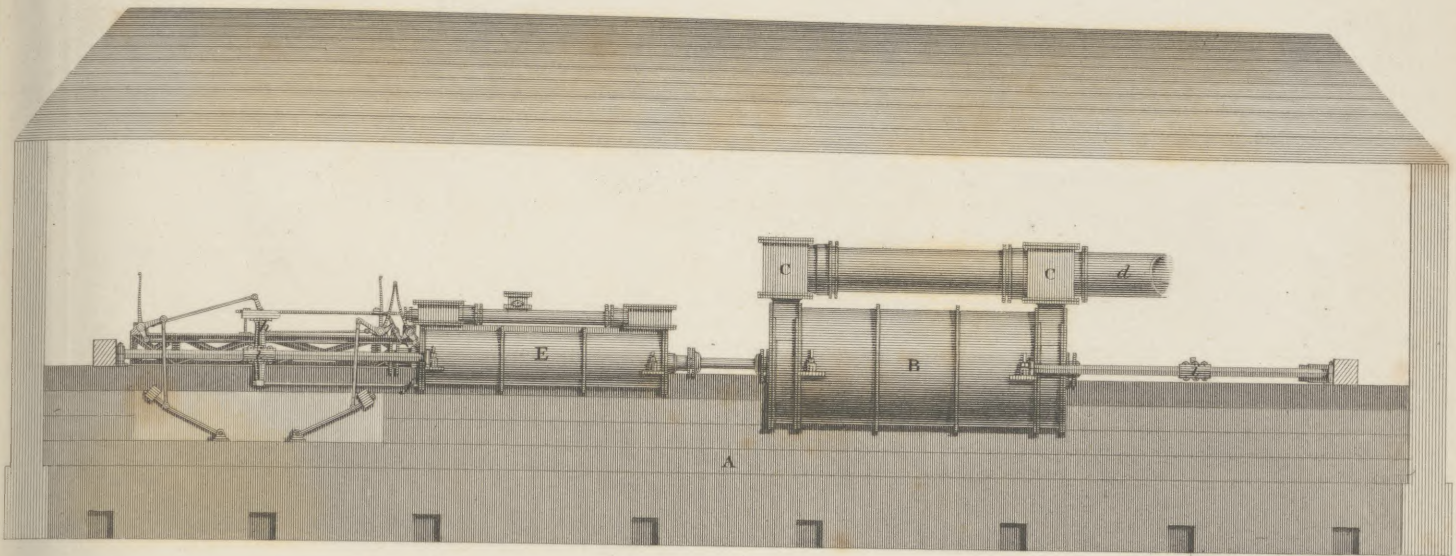


IRON–MAKING.

PLATE CCCX.

BLAST ENGINE, Erected at Wylam Iron Works, by R.& W. HAWTHON, Civil Engineers, NEWCASTLE upon TYNE.

ELEVATION. Fig. 1.



CROSS SECTION.

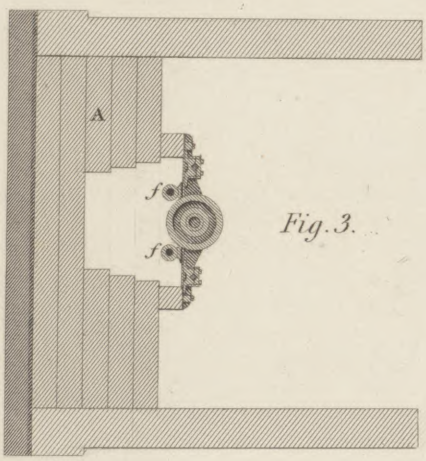


Fig. 3.

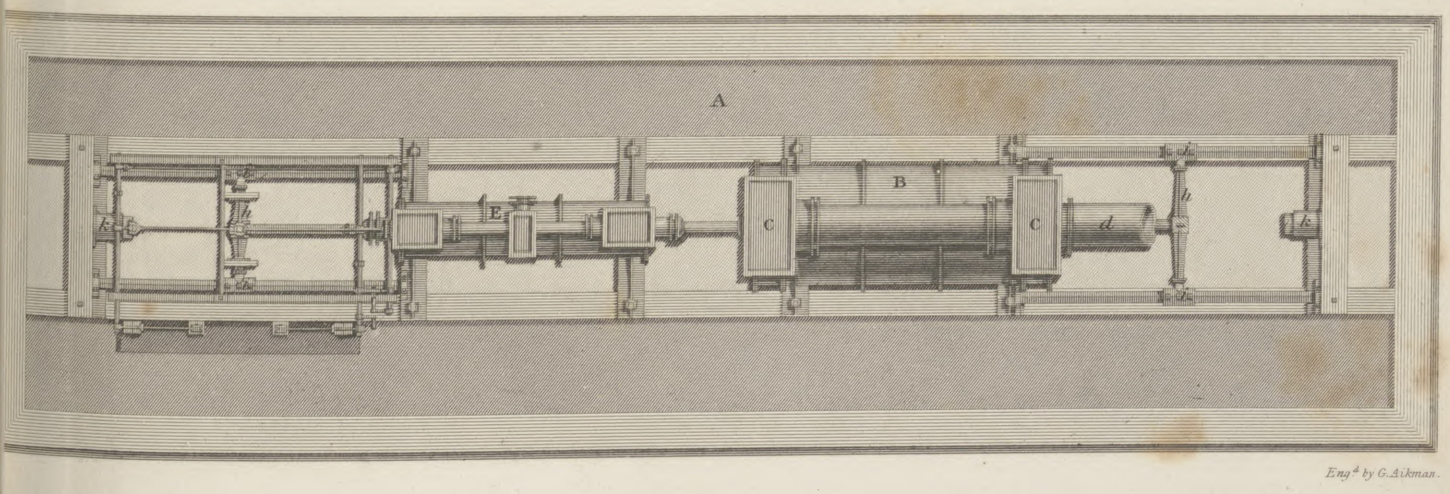
REFERENCE.

A,A. — *Represents the Pillar on which the Engine is fixed.*
B,B. — *The Blast Cylinder.*
C,C. — *The Wind Boxes in which are fixed the discharging valves.*
d,d. — *The Blast Pipe leading to the Furnaces.*
E,E. — *The Steam Cylinder.*
f,f. — *The Force Pumps.*
g,g. — *The Hand or Working Gear.*
h,h. — *The Cross heads.*
i,i,i,i. — *The Slides for guiding the Piston Rods.*
k,k. — *The Banging Boxes.*

SCALE.

0 5 10 15 20 Feet.

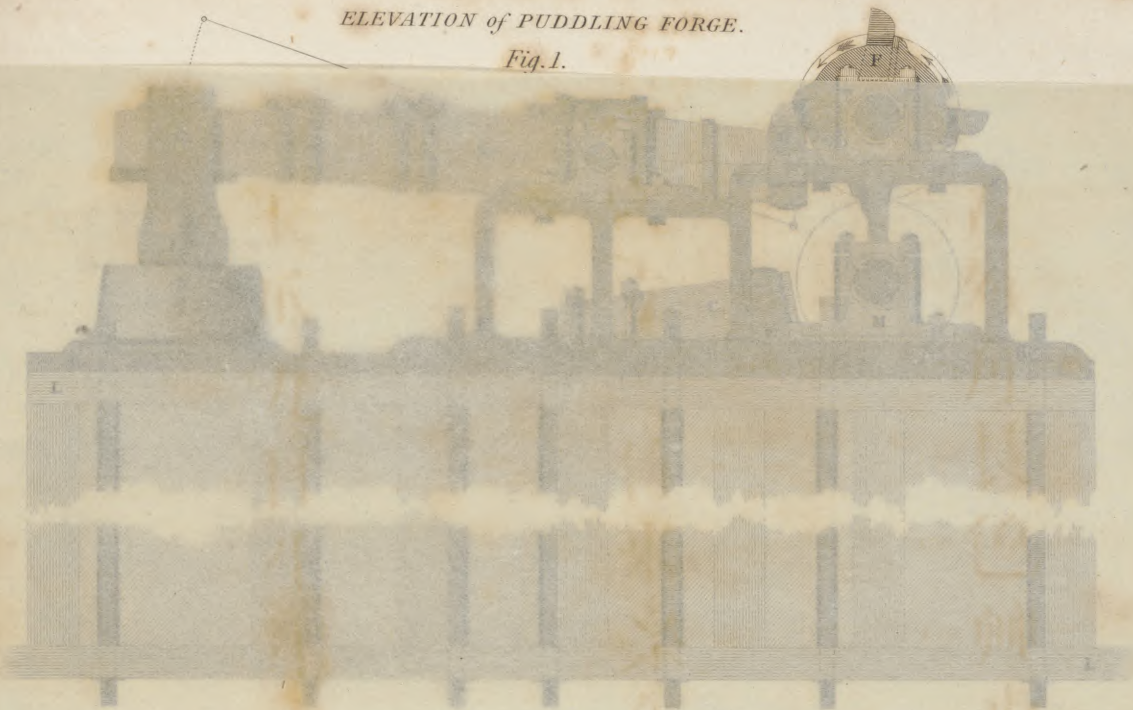
PLAN. Fig. 2.



Engd by G. Aikman.

ELEVATION of PUDDLING FORGE.

Fig. 1.



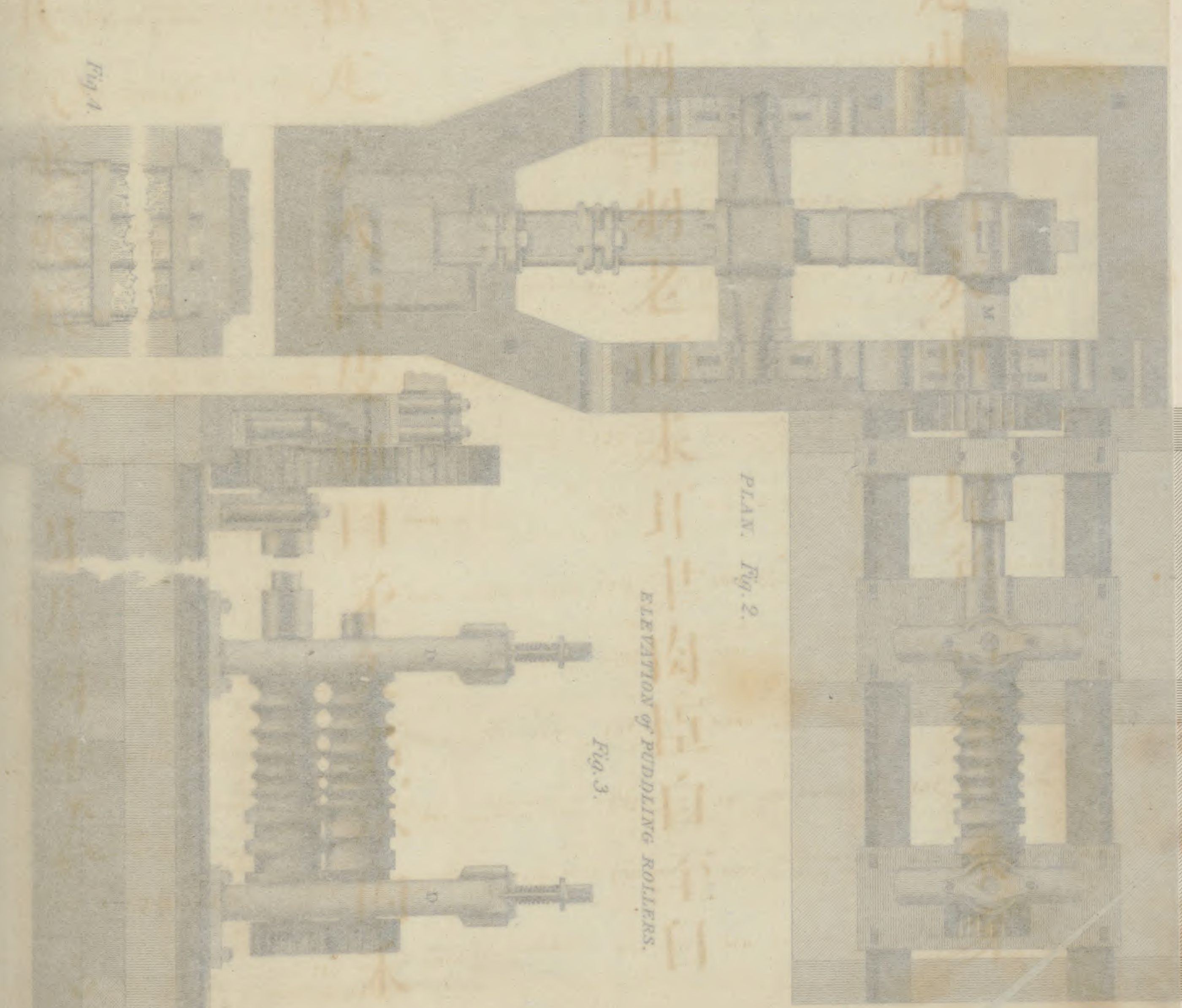


Fig. 4.

PLAN. Fig. 2.

ELEVATION of PUDDLING ROLLERS.

Fig. 3.

Engd. by G. Aikman.

ELEVATION of PUDDLING FORGE.

Fig. 1.

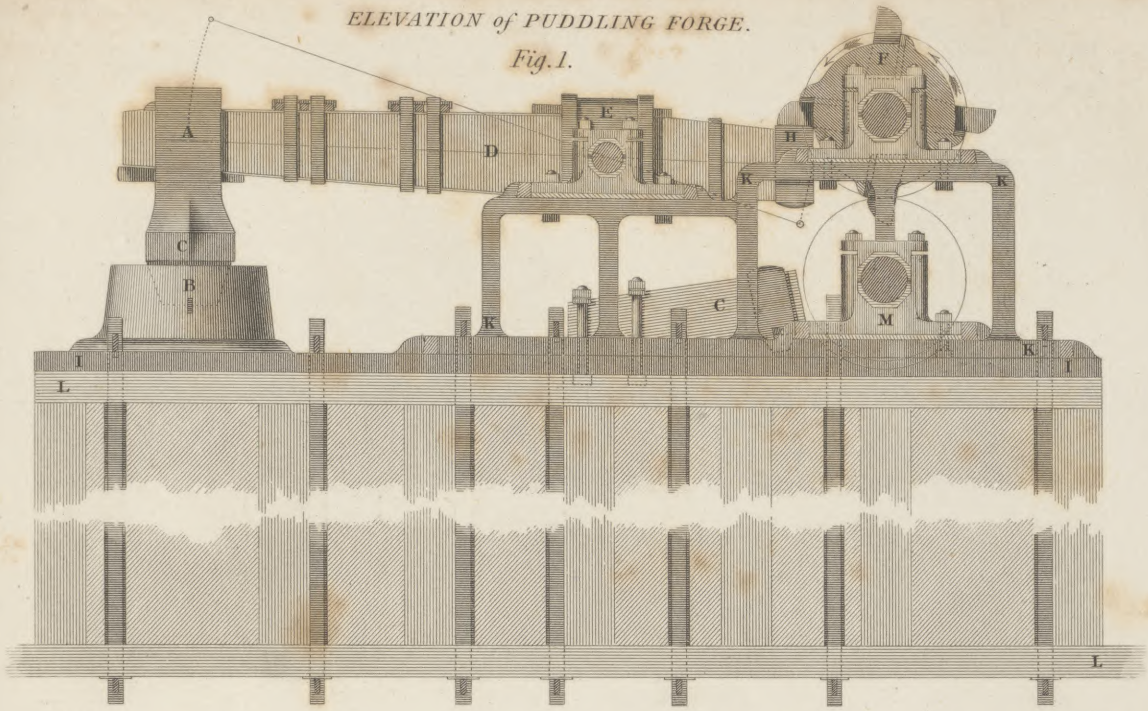
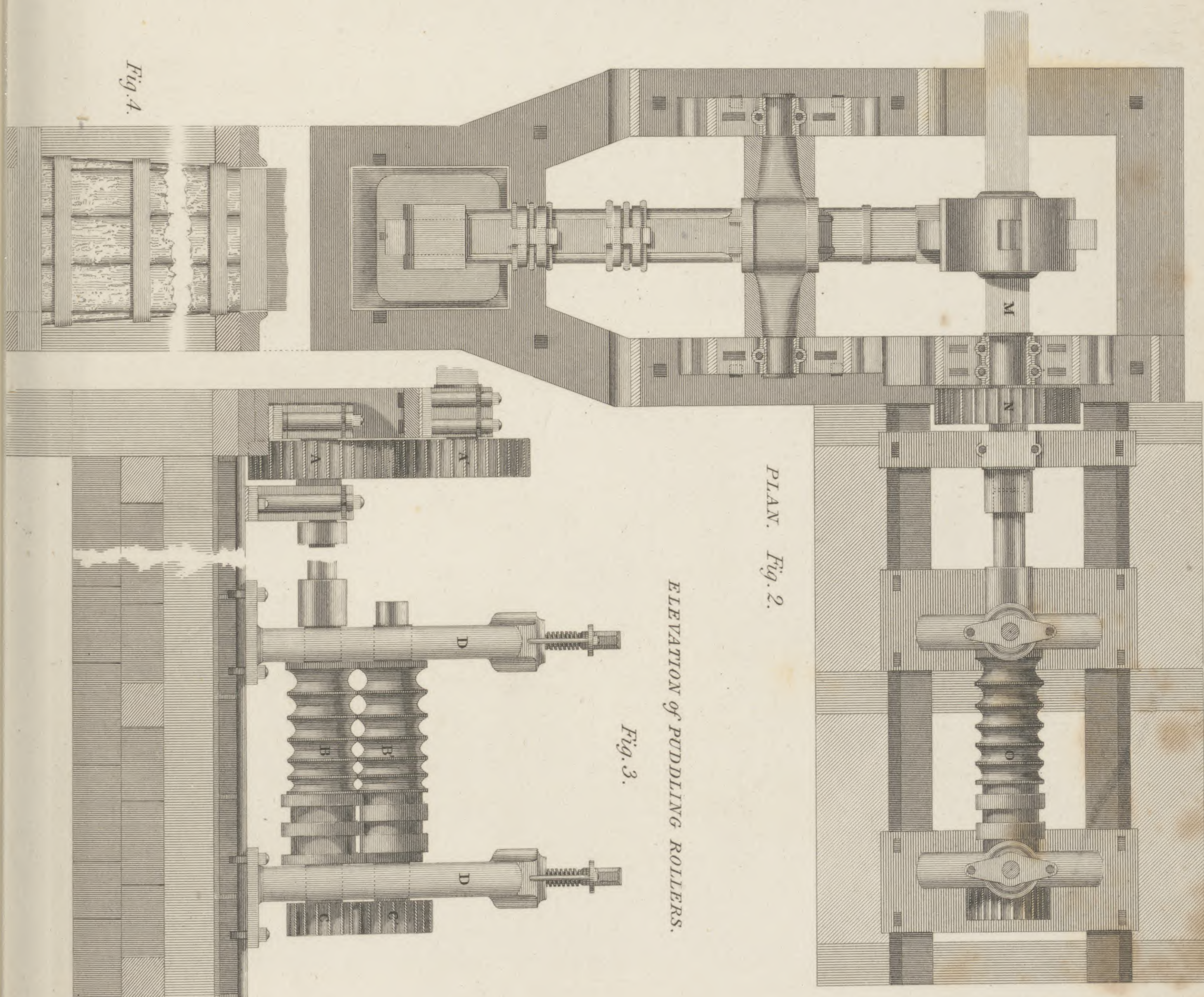


Fig. 4.

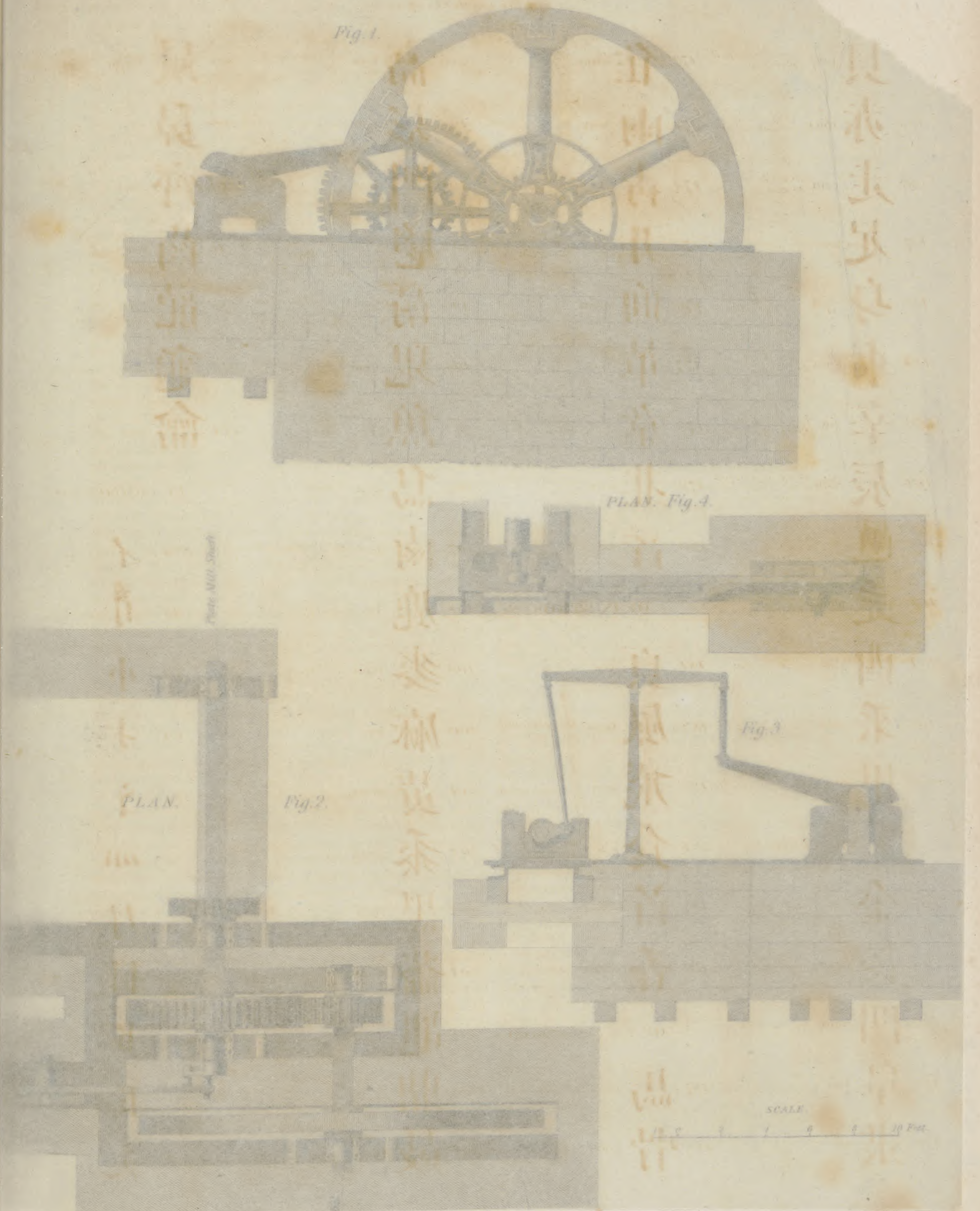
PLAN. *Fig. 2.*

ELEVATION of PUDDLING ROLLERS.

Fig. 3.



ELEVATION of WHEELS for BAR-IRON MILL.



Eng^d by G. Aikman.

鼻齊齒龍龜龠

亻犭忄扌氵灬 [illegible]

高髟鬥鬯鬲鬼魚鳥鹵鹿麥麻黃黍黑黹黽鼎鼓鼠

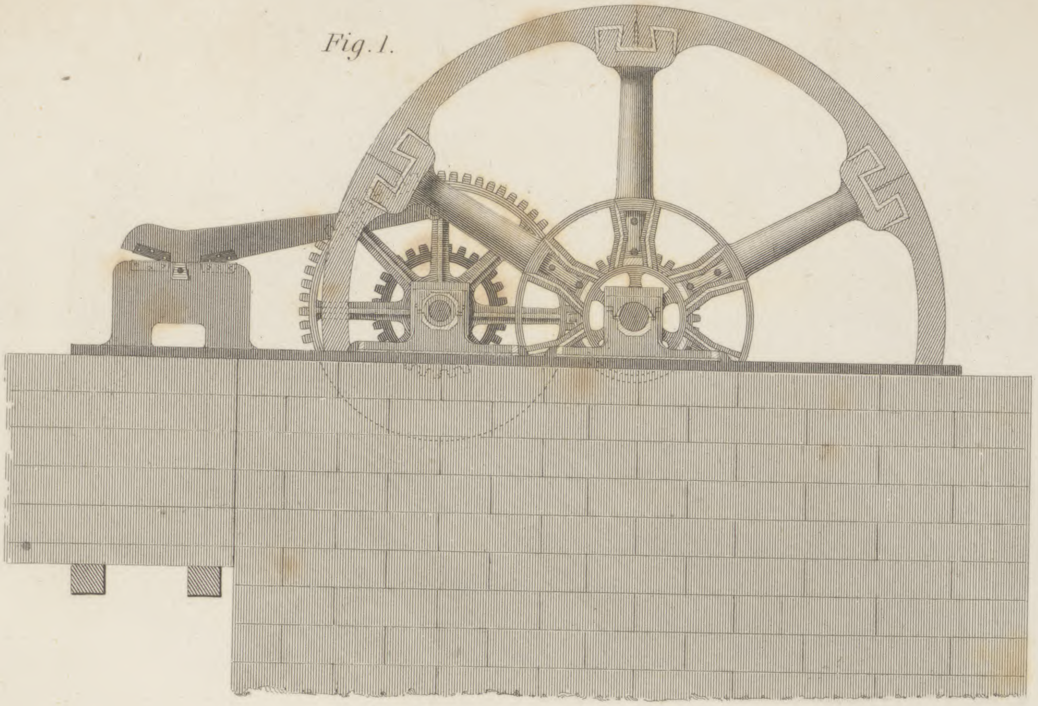
隹雨青非面革韋韭音 頁風飛食首香 馬骨

貝赤走足身車辛辰辵邑酉釆里 金長門阜隶

IRON-MAKING.

ELEVATION of WHEELS for BAR-IRON MILL.

Fig. 1.



PLAN. Fig. 4.

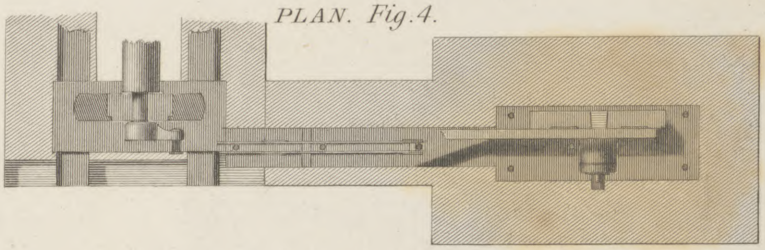
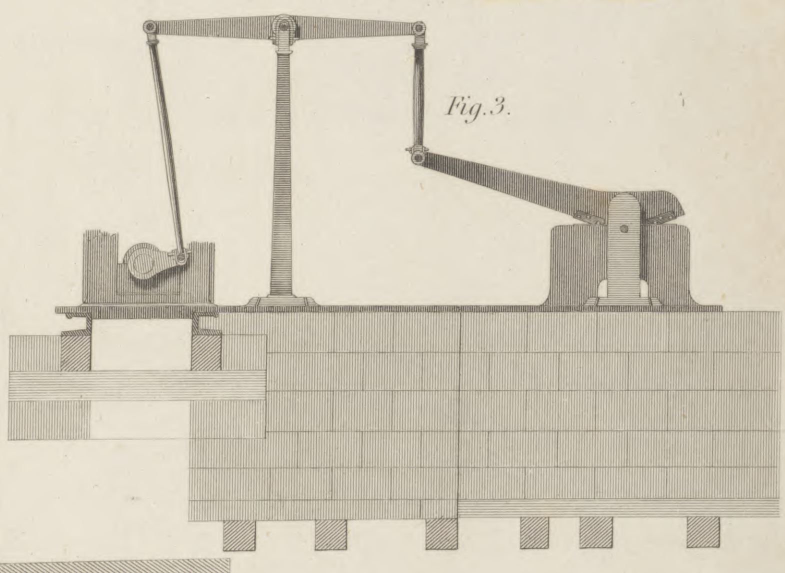
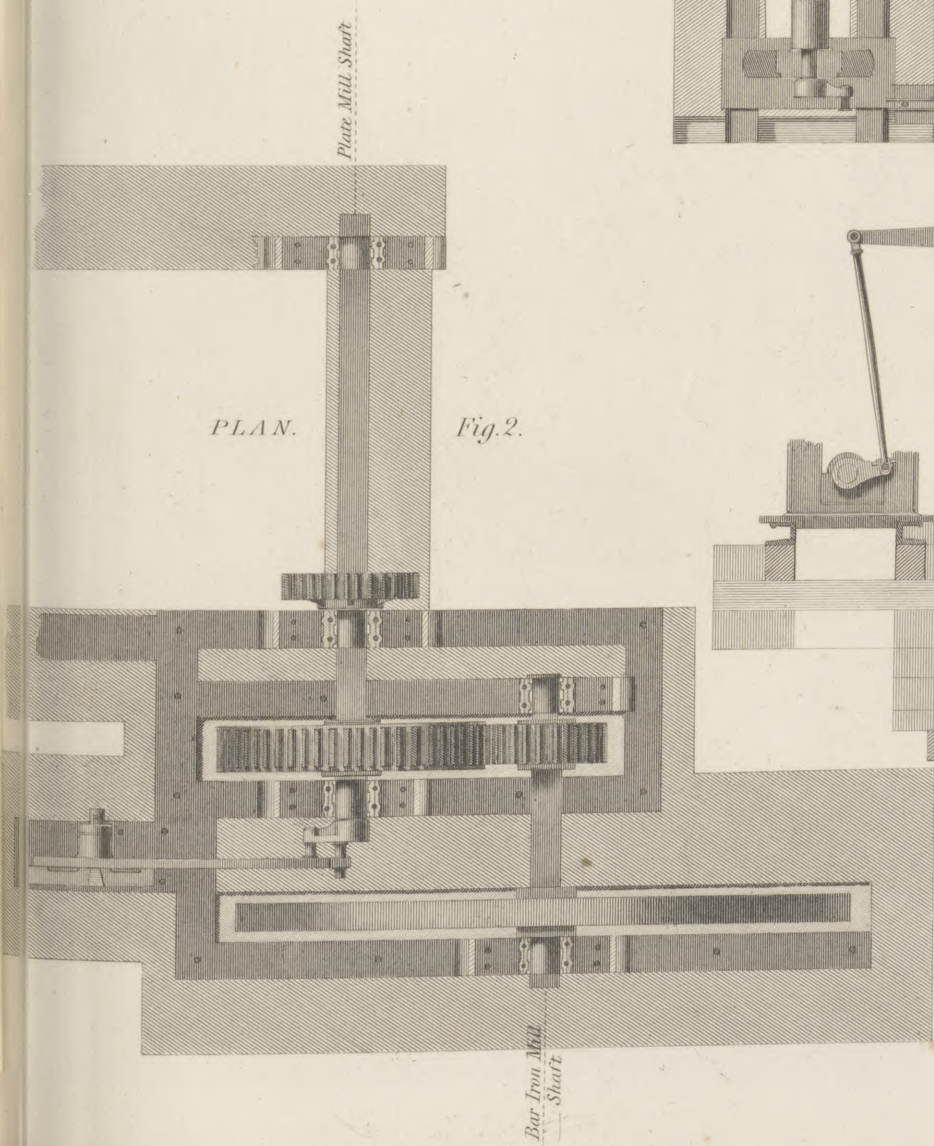


Fig. 3.



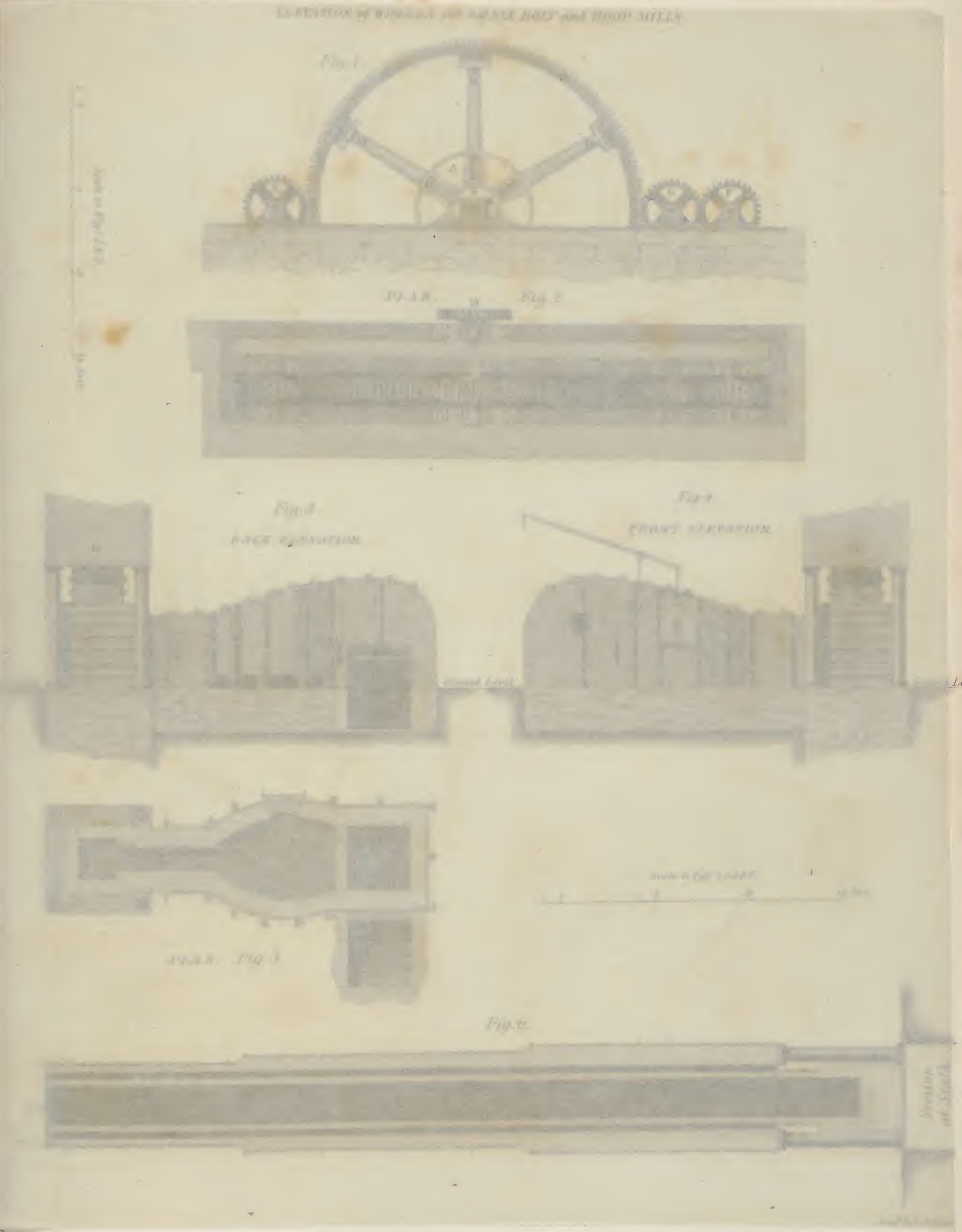
PLAN. *Fig. 2.*



SCALE.

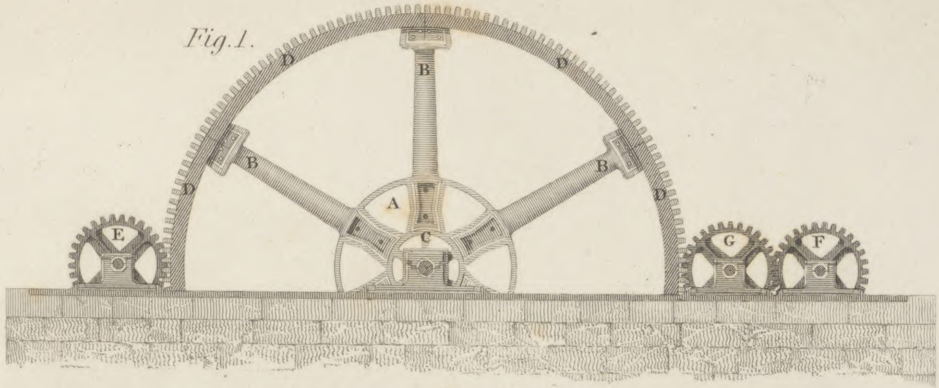
1 0 2 4 6 8 10 Feet.

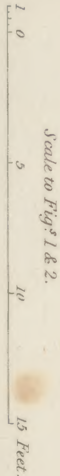
Eng.d by G. Aikman.



ELEVATION of WHEELS for SMALL BOLT and HOOP MILLS.

Fig. 1.





PLAN. *Fig. 2.*

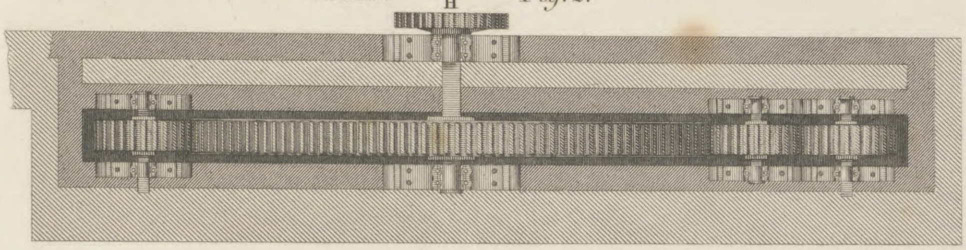


Fig. 3.

BACK ELEVATION.

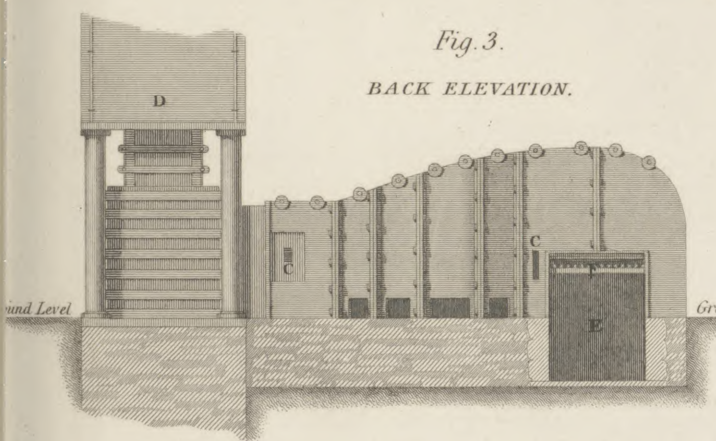
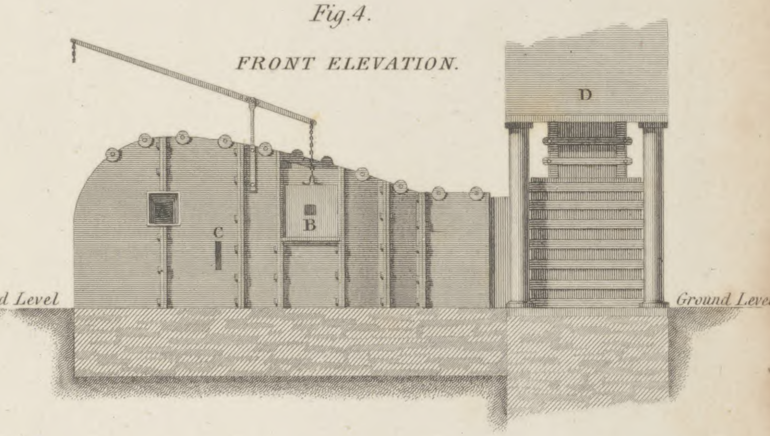
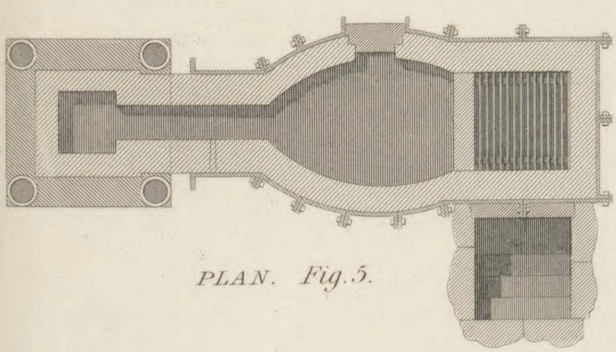


Fig. 4.

FRONT ELEVATION.





PLAN. *Fig. 5.*

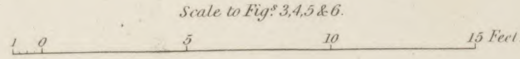
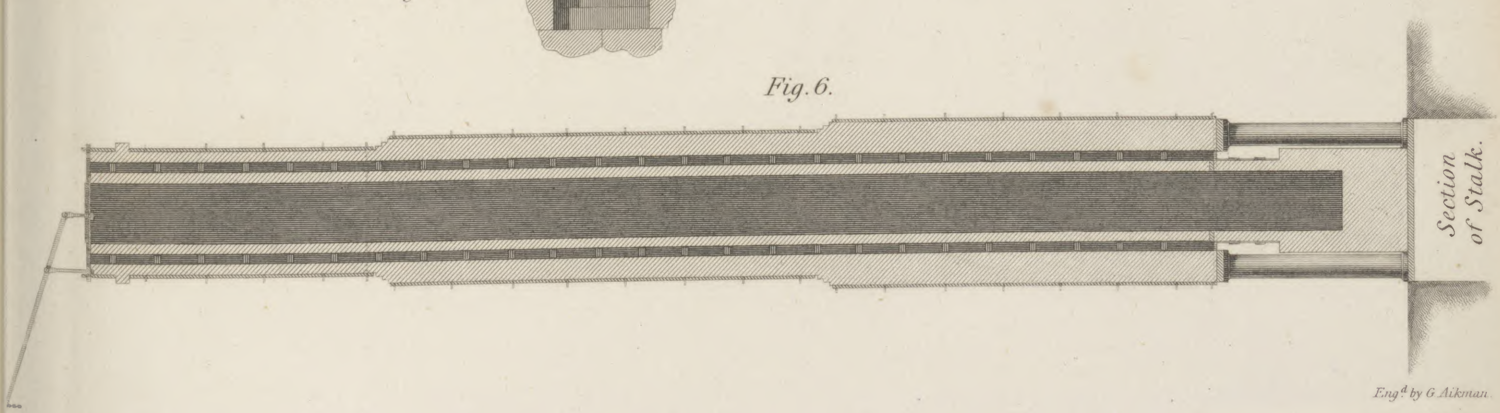
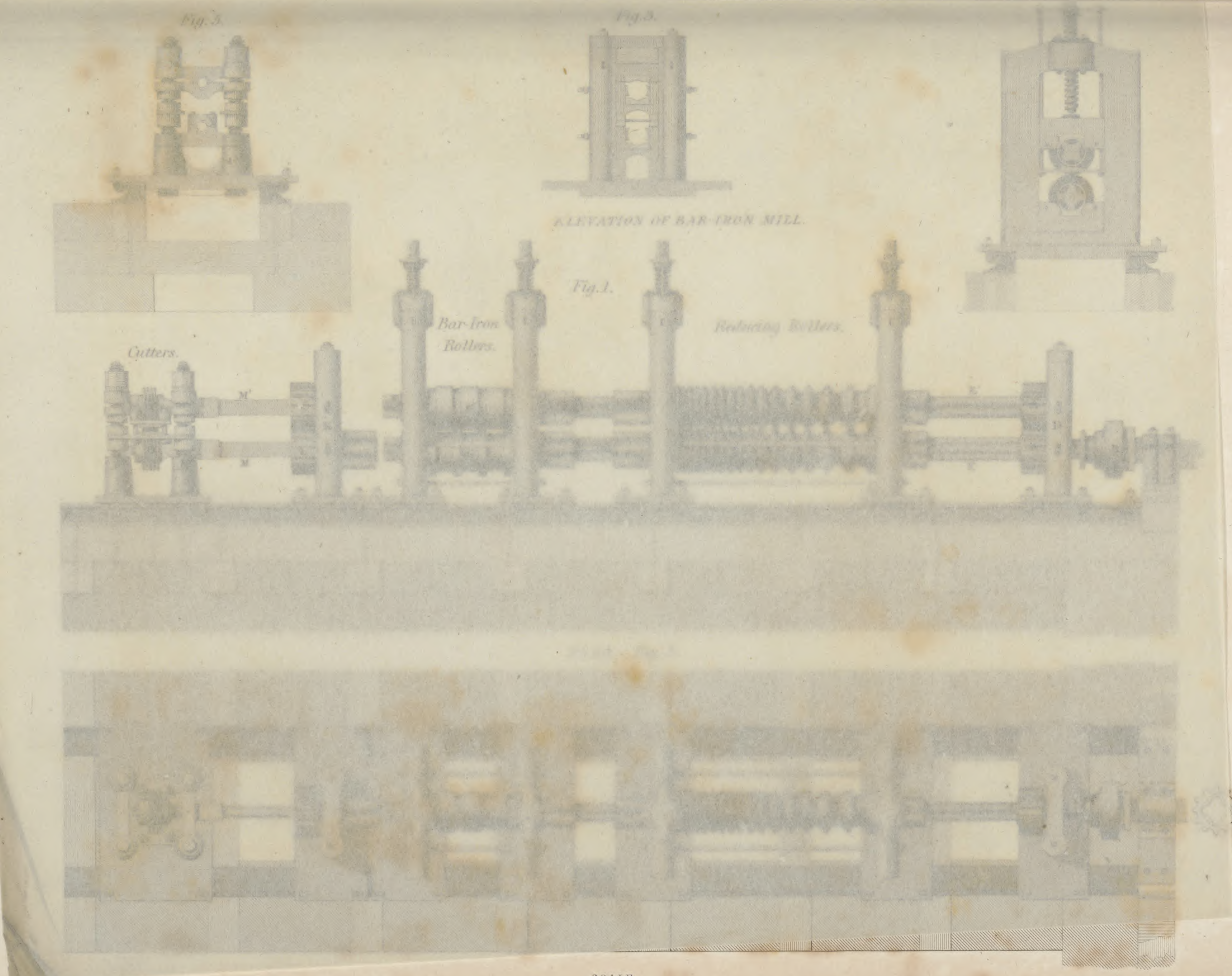


Fig. 6.



Eng.d by G. Aikman.



SCALE.

Inches 12 6 0 1 2 3 4 5 6 7 8 9 10 Feet.

Eng^d by G. Aikman.

Fig. 5.

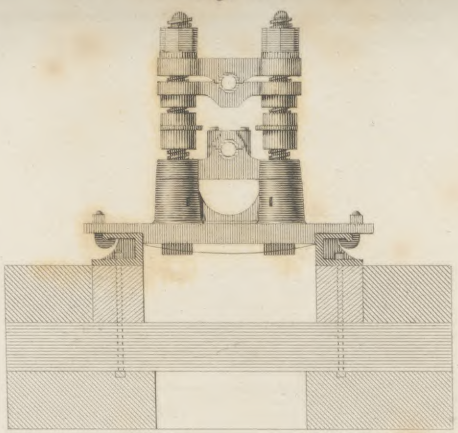


Fig. 3.

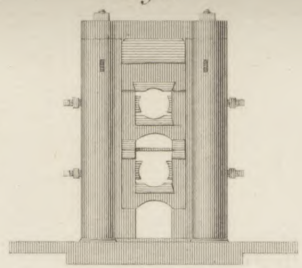
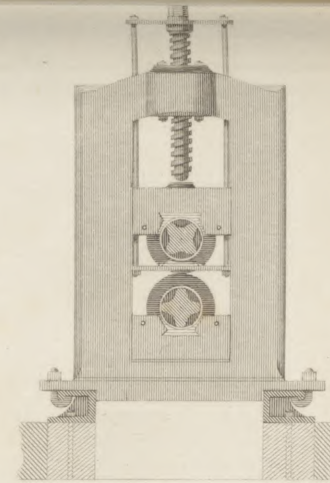
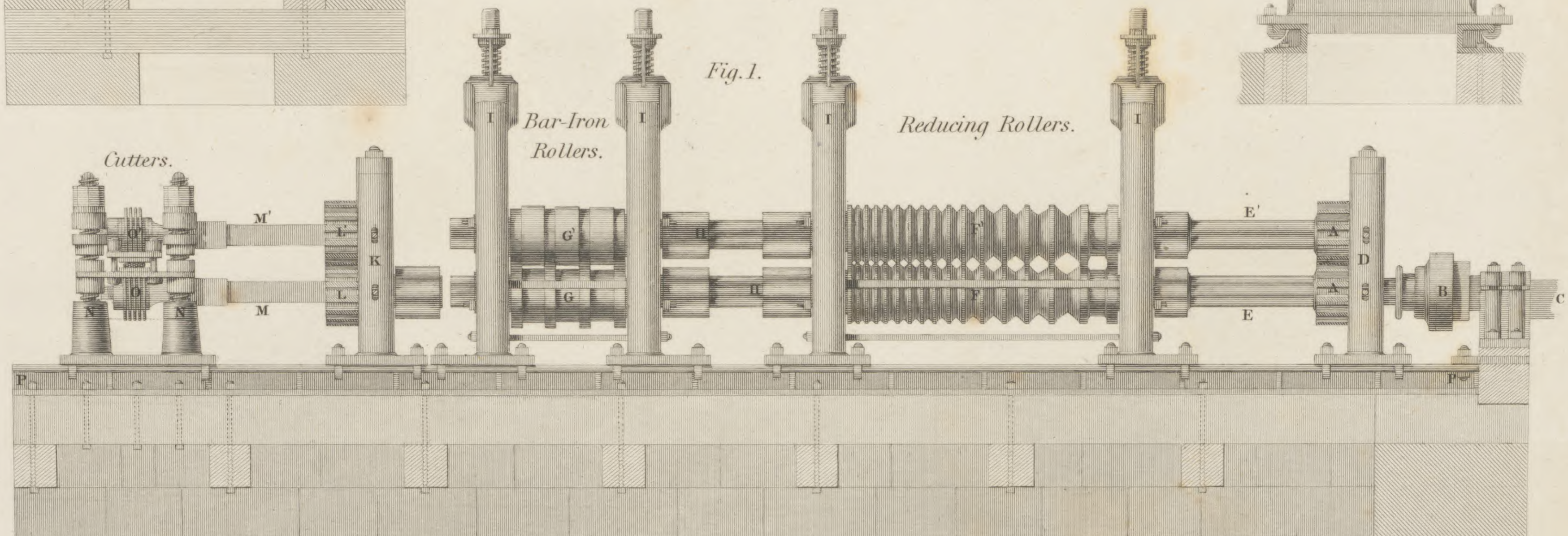


Fig. 4.

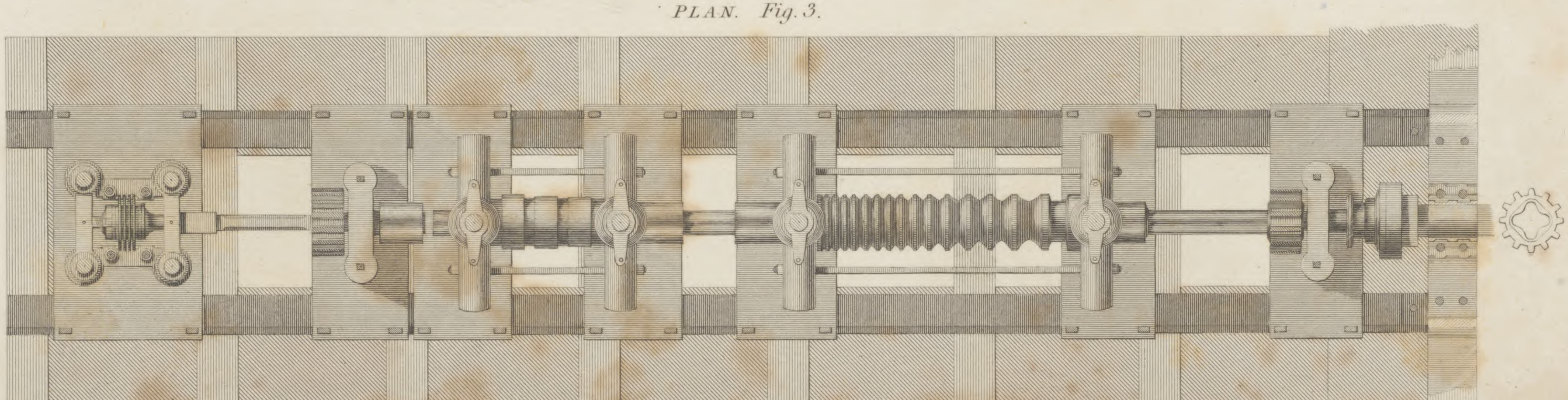


ELEVATION OF BAR-IRON MILL.

Fig. 1.



PLAN. Fig. 3.

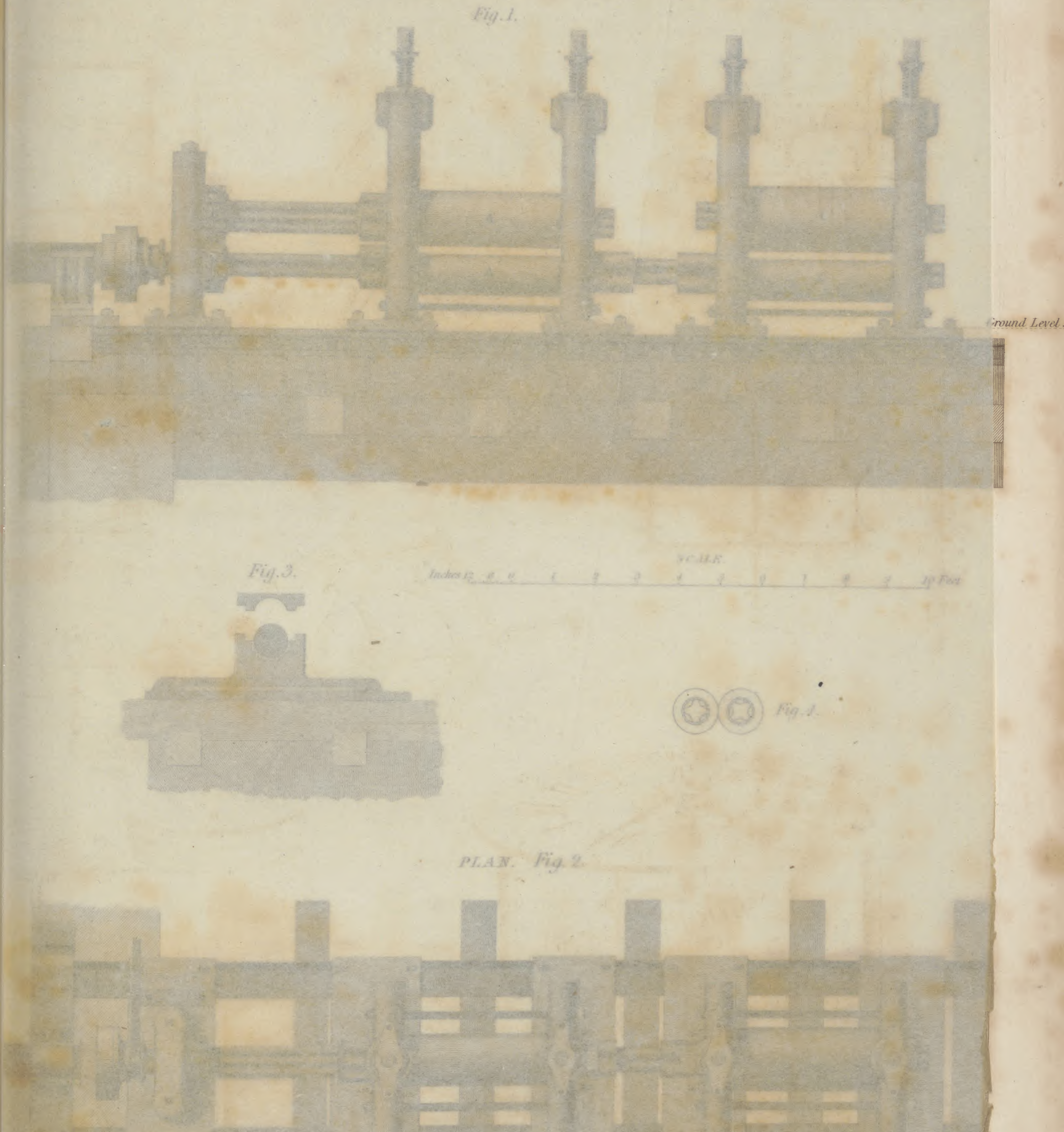


SCALE.

Inches 12 6 0 1 2 3 4 5 6 7 8 9 10 Feet.

Eng^d by G. Aikman.

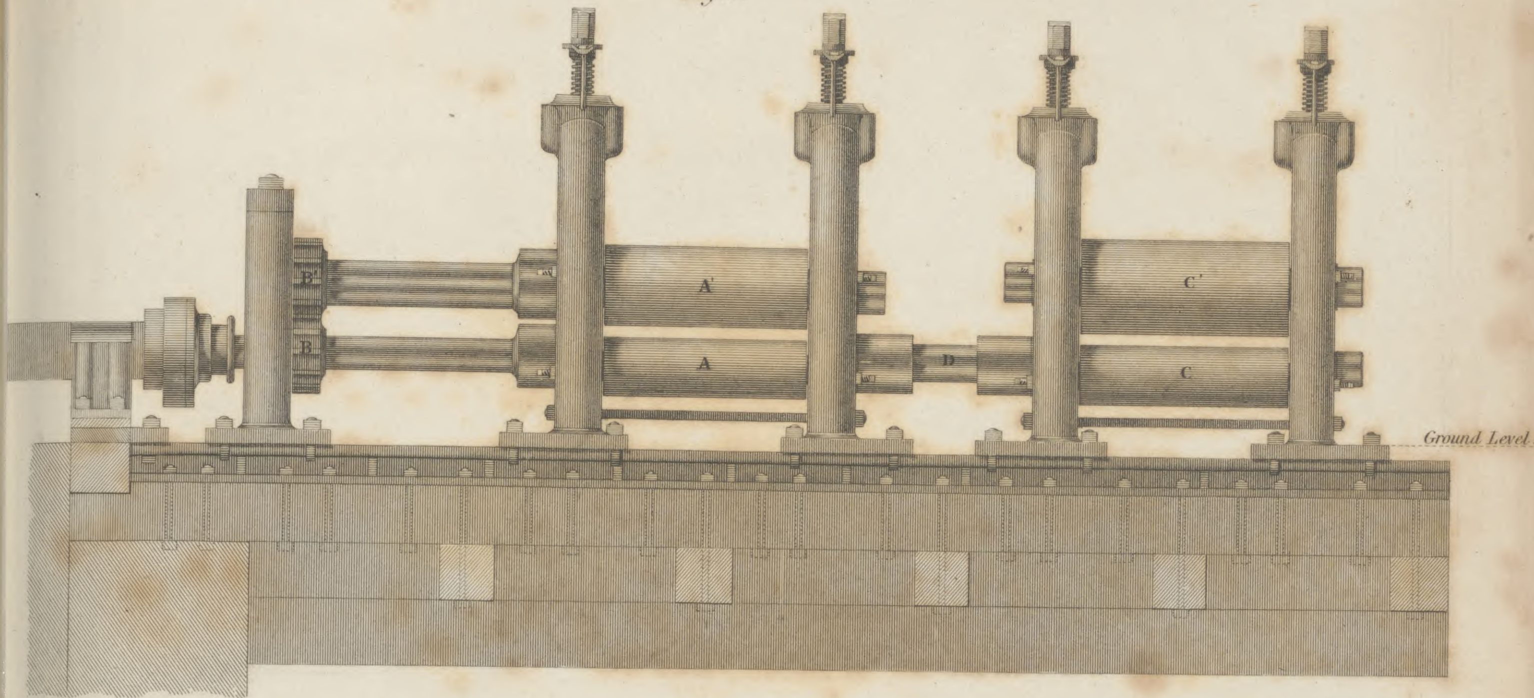
ELEVATION of BOILER-PLATE and SHEET-IRON ROLLERS.



Eng^d by G. Aikman.

ELEVATION of BOILER-PLATE and SHEET-IRON ROLLERS.

Fig. 1.



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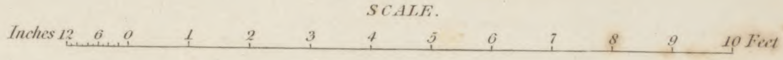


Fig. 3.

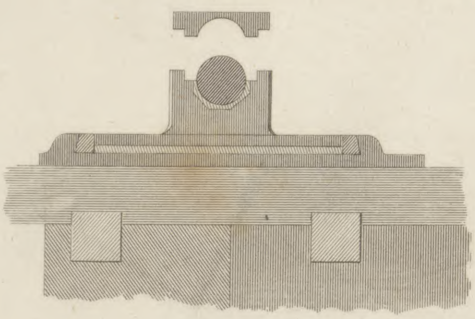
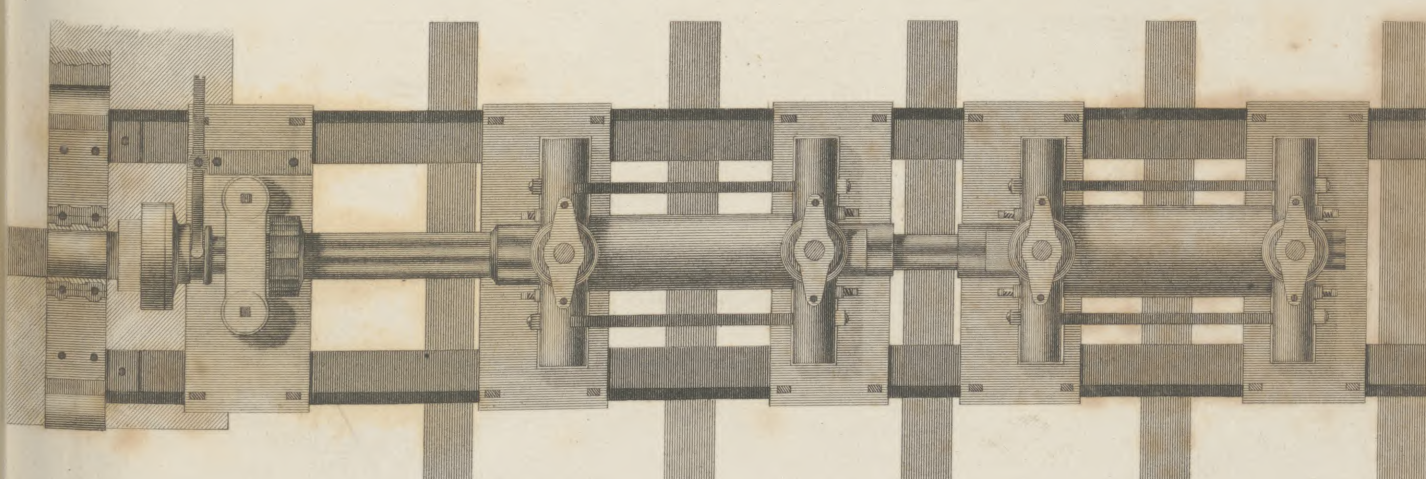


Fig. 4.

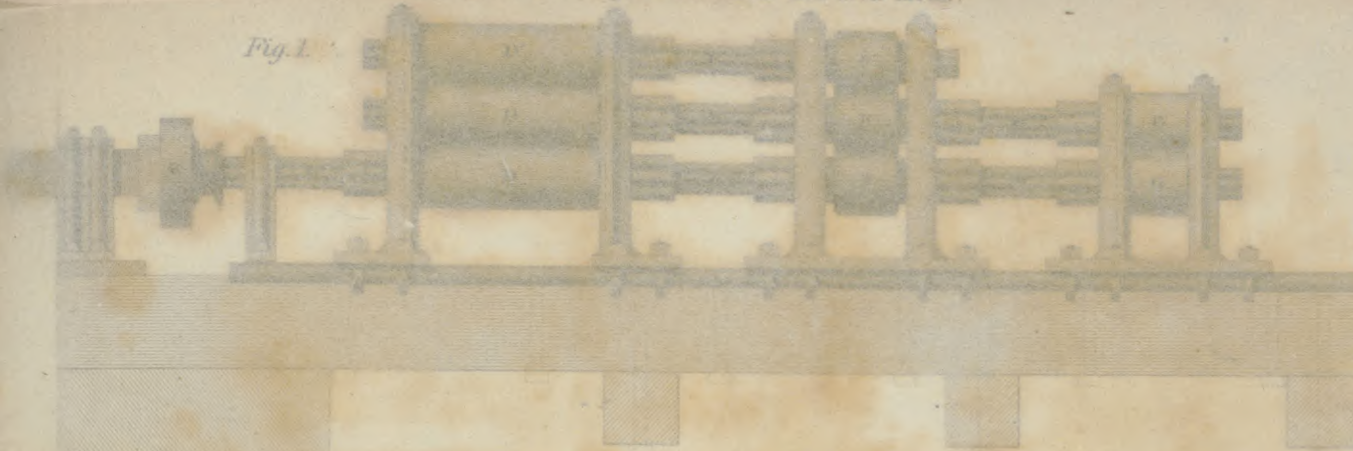
PLAN. Fig. 2.



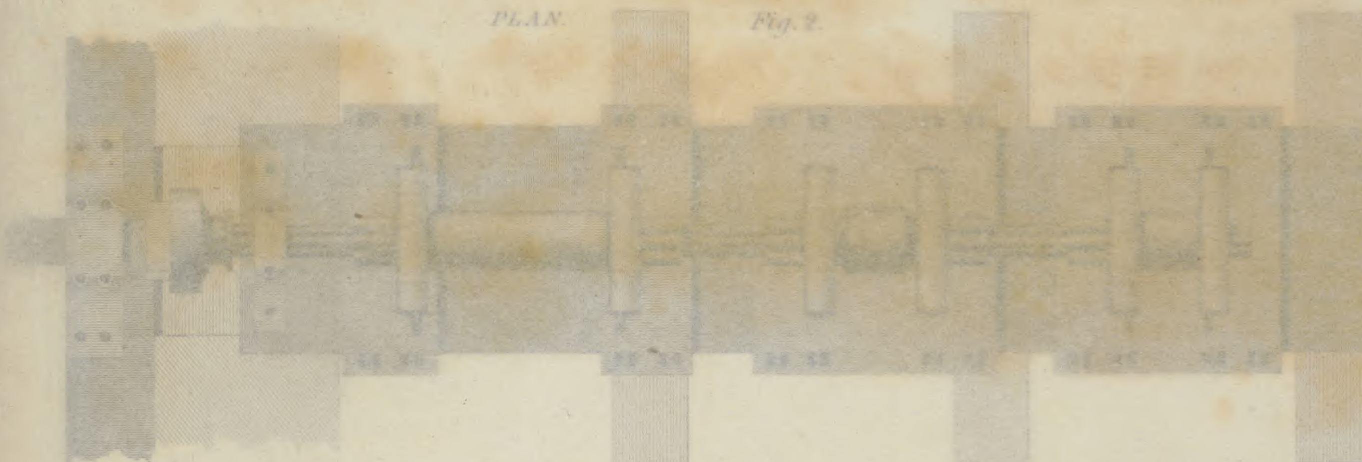
Engd. by G. Aikman.

ELEVATION of SMALL BOLT and ROD MILL.

Fig. 1.

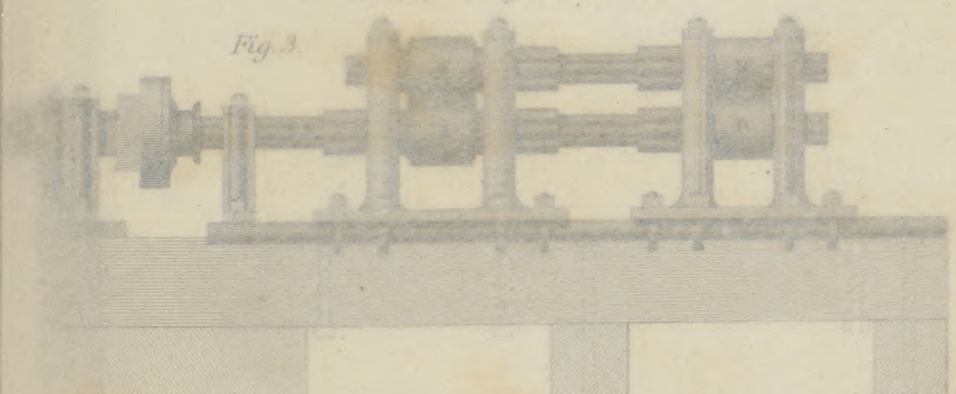


PLAN. Fig. 2.



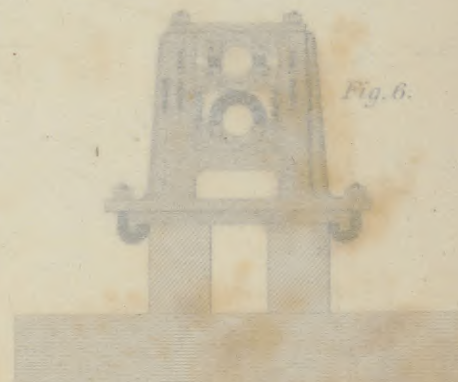
ELEVATION of HOOP MILL.

Fig. 3.



END VIEW of STANDARD.

Fig. 6.



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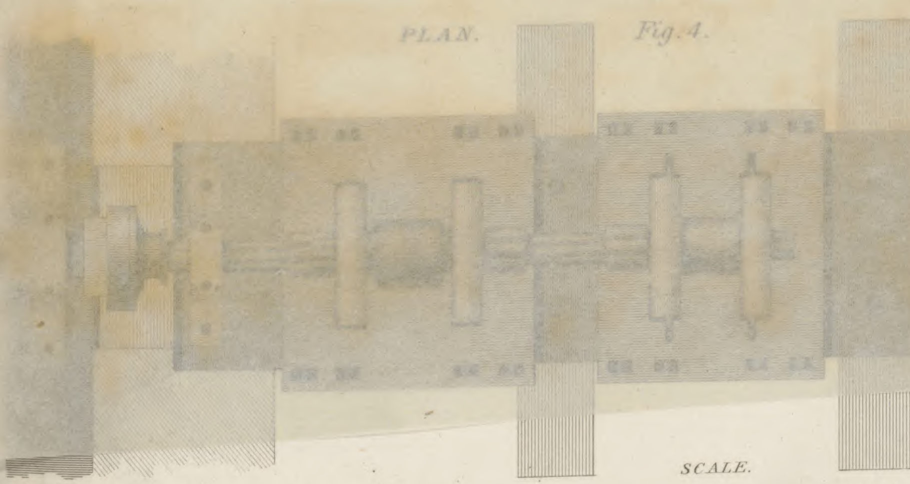

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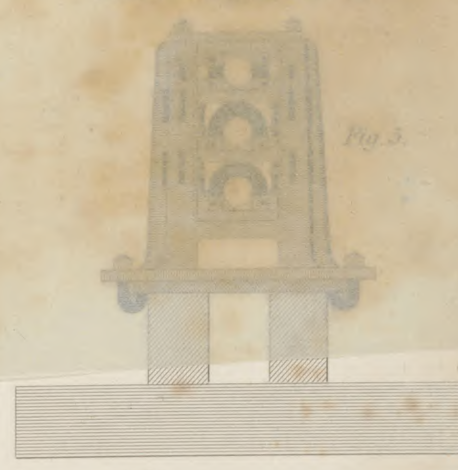
Fig. 5.



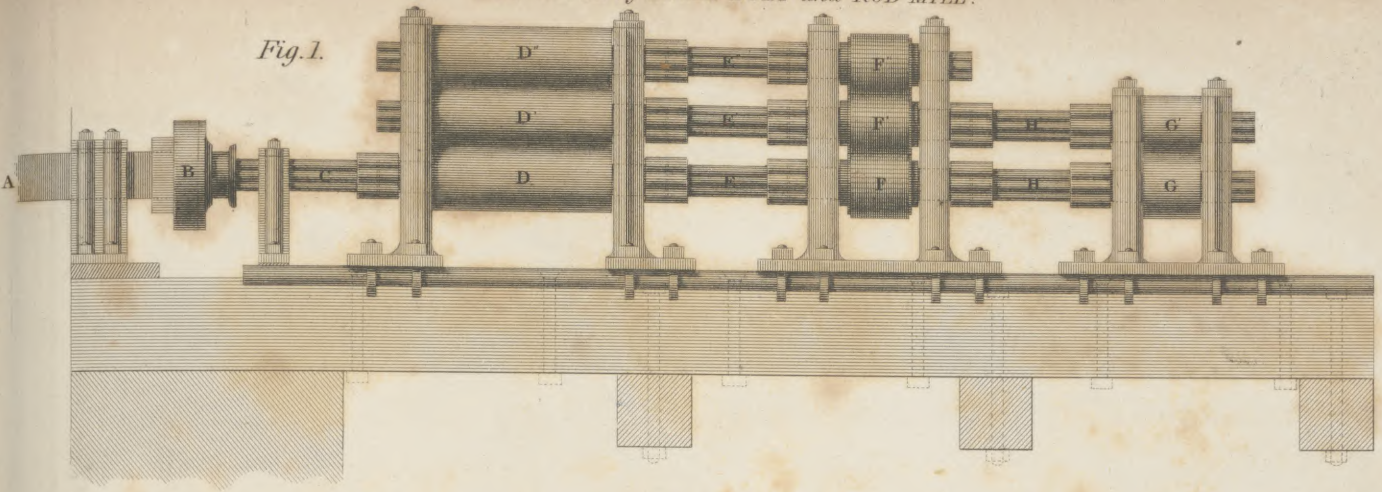
SCALE.

Inches 12 6 0 1 2 3 4 5 6 7 Feet.

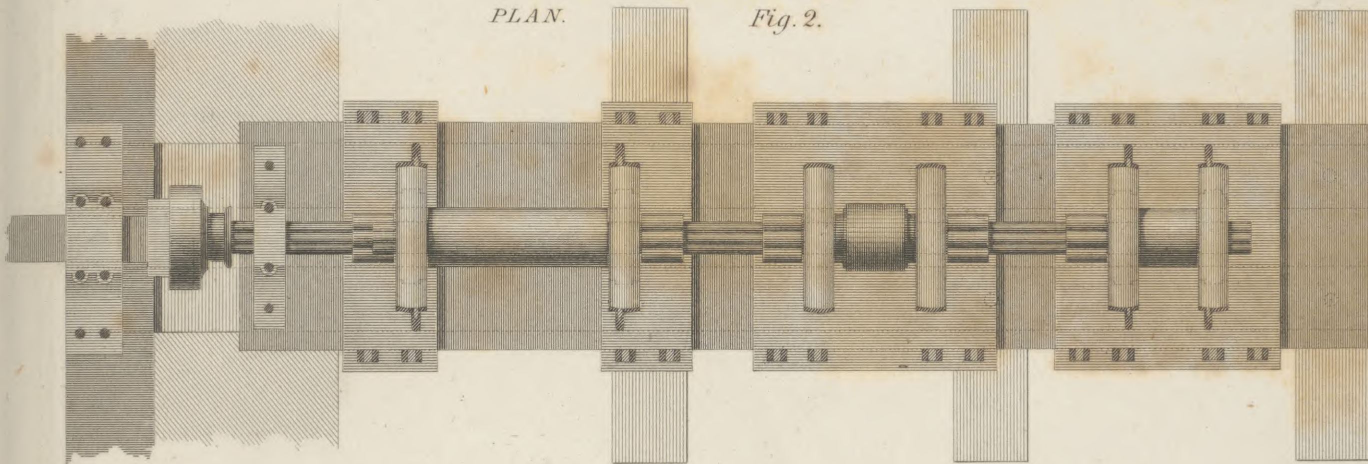
Eng^d by G. Aikman

ELEVATION of SMALL BOLT and ROD MILL.

Fig. 1.

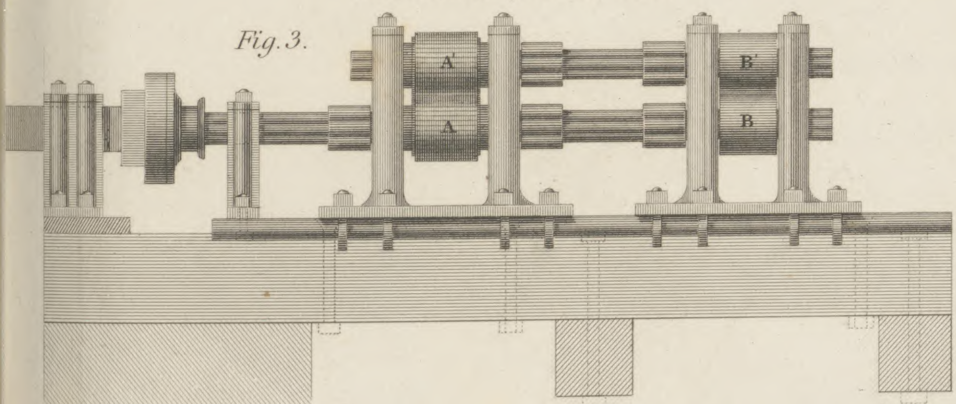


PLAN. Fig. 2.



ELEVATION of HOOP MILL.

Fig. 3.



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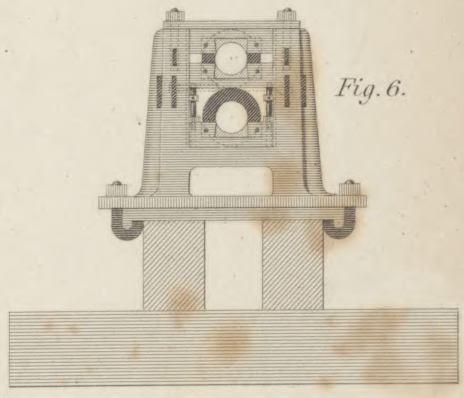
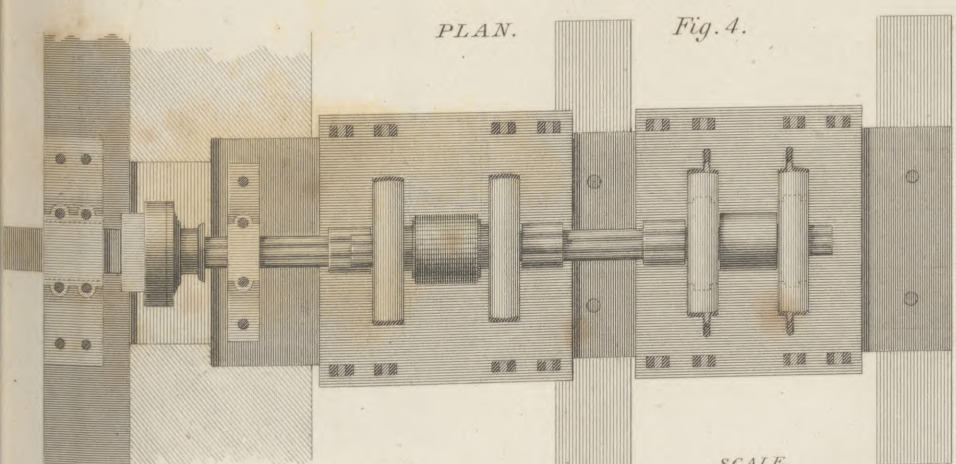


Fig. 6.

PLAN. Fig. 4.



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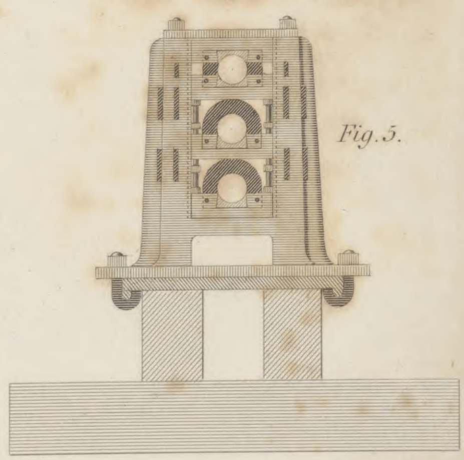

Fig. 5.

SCALE.

Inches 12 6 0 1 2 3 4 5 6 7 Feet.

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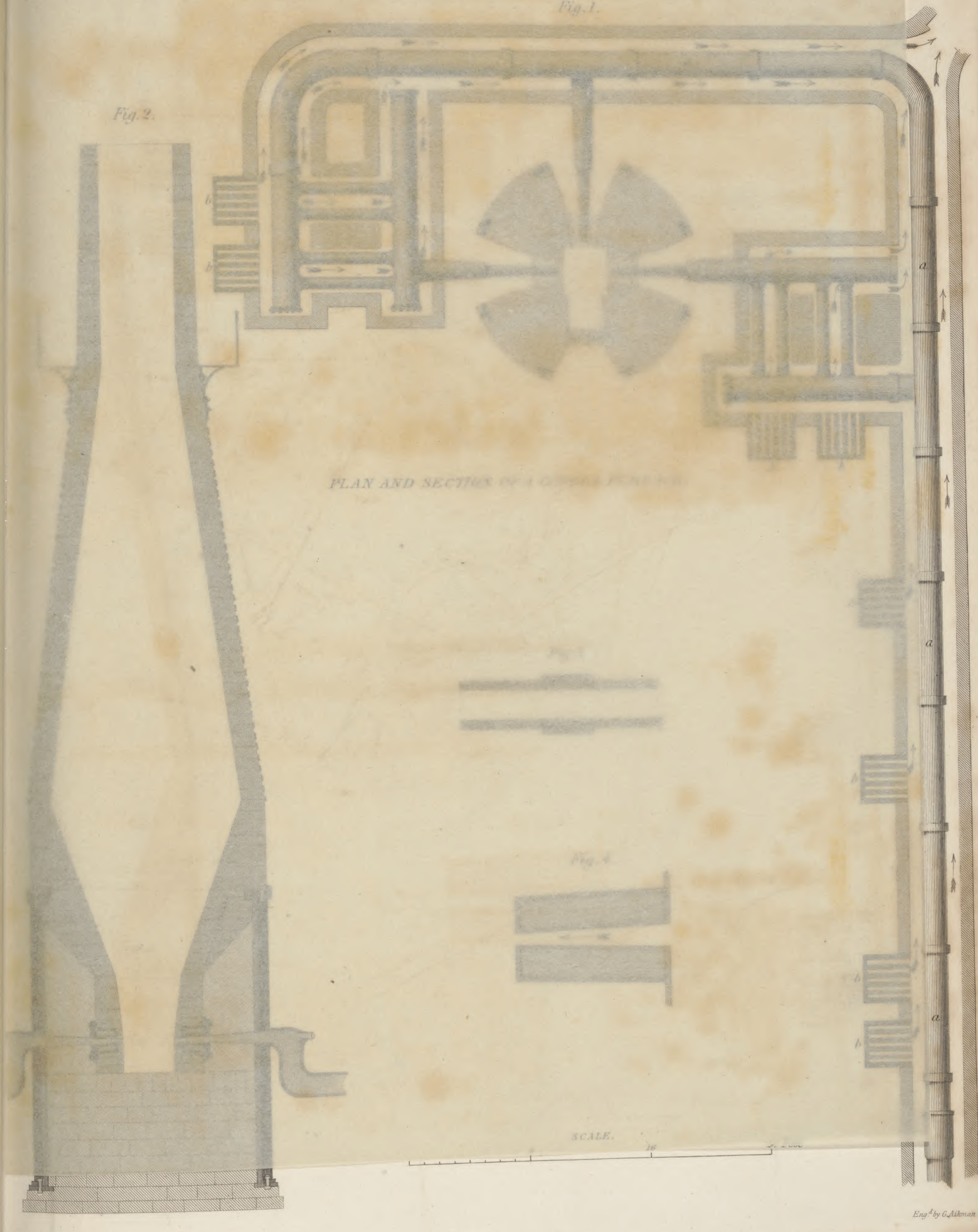

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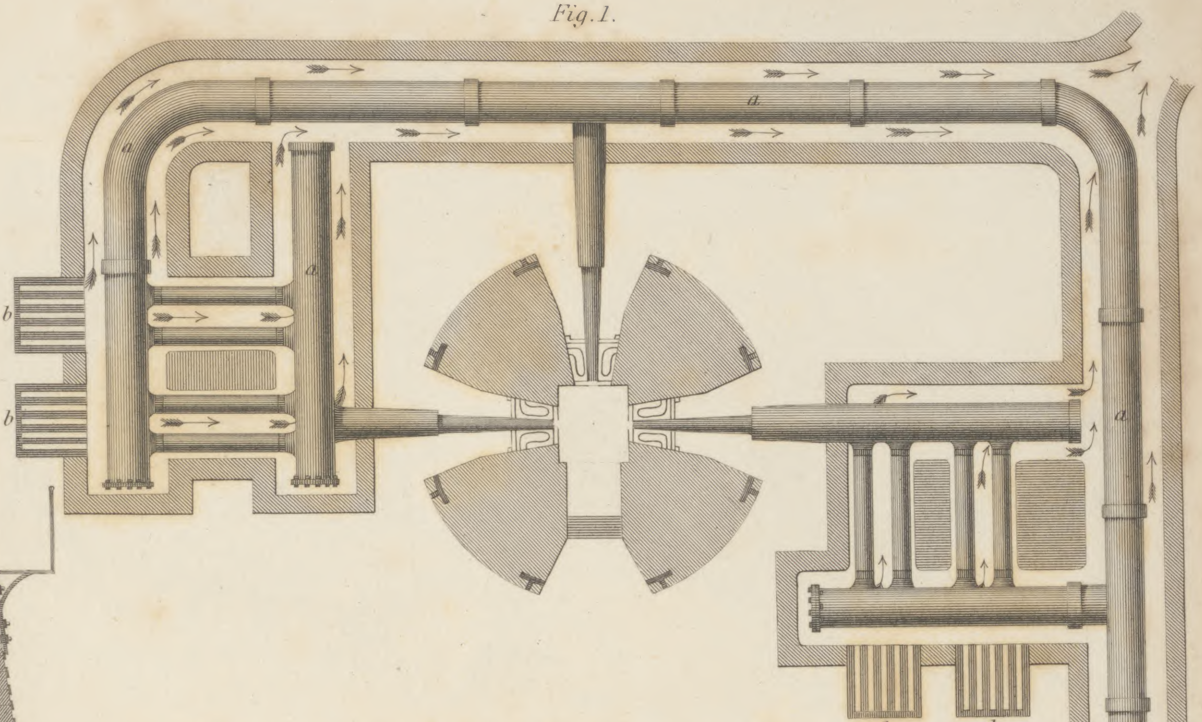
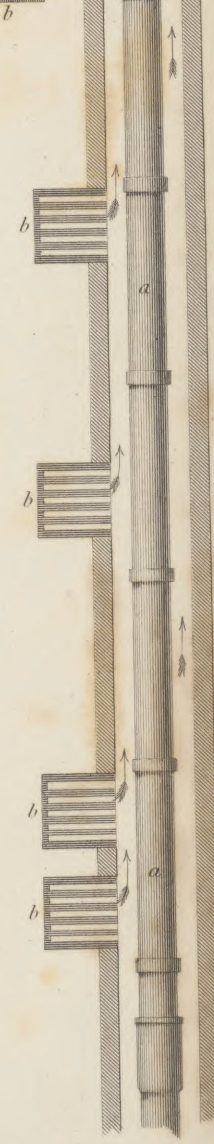
Fig. 1.

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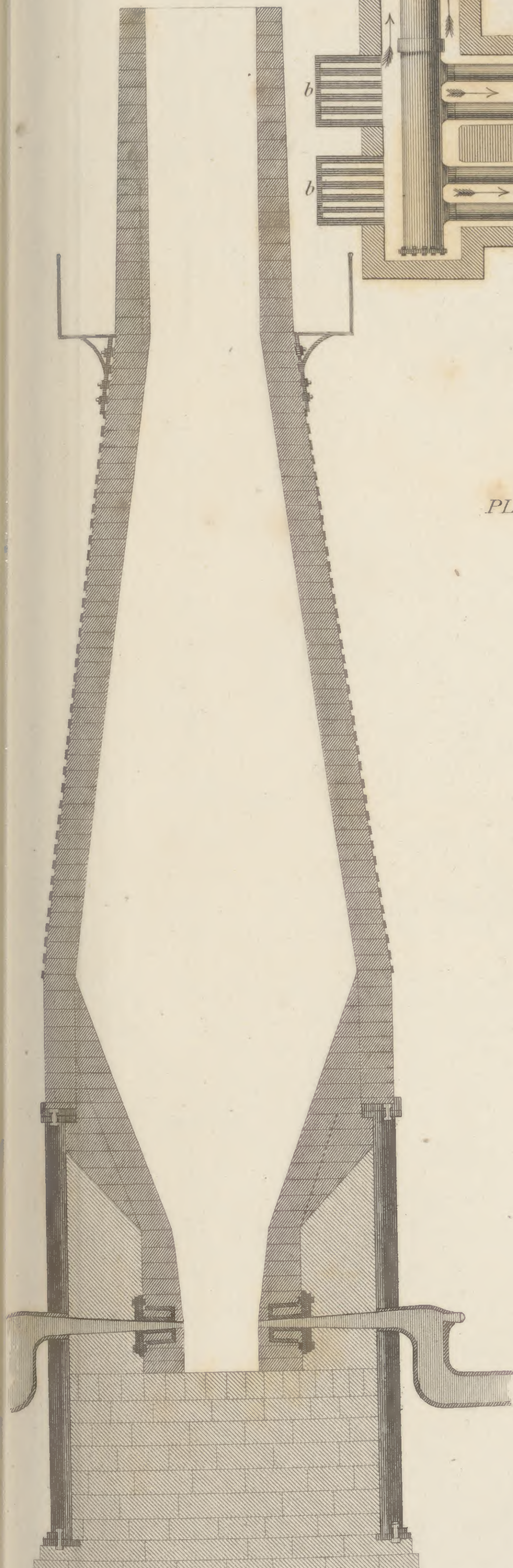


PLAN AND SECTION OF A CUPOLA FURNACE.

Fig. 3.

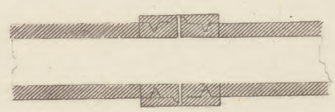
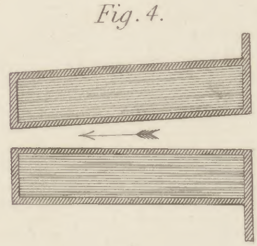
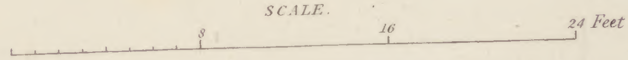


Fig. 4.





Eng.d by G. Aikman

S W I T Z E R L A N D
F R A N C E
S A R D I N I A N S T A T E S
P I E D M O N T
C O R S I C A
G. OF GENOA
Strait of Bonifacio
CAPO DI SASSARI
Lausanne
Geneva
Chambery
Grenoble
Briançon
Mont Dauphin
Embrun
Barcelonnete
M.S.Gothard
M.Rosa
Mt Blanc
M.Cenis
M.Viso
Aosta
Ivrea
Turin
Susa
Chivasso
Vercelli
Novara
Milan
Como
Lugano
Bellinzona
Bergamo
Brescia
Verona
Mantua
Cremona
Piacenza
Parma
Modena
Reggio
Alessandria
Asti
Alba
Cuneo
Mondovi
Savona
Genoa
Spezzia
Nice
Antibes
Frejus
Hieres Is.
Monaco
Oneglia
Albenga
Lucca
Pisa
Leghorn
Florence
Volterra
Piombino
Elba
Capraja
Pianosa
Montecristo
Bastia
Calvi
Corte
Ajaccio
Sartena
Bonifacio
Porto Vecchio
Asinara I.
Trent
Longitude East 11 from Greenwich


ITALY,
NORTH PART.
English Miles
ADRIATIC SEA
DALMATIA
Trieste
Capo d'Istria
Villach
Spalatro
Trau
Sebenico
Lissa
Curzola
Lagosta
Brazza
G. of Manfredonia
ABRUZZO
ULTRA
Chieti
Ancona
Fermo
Vicenza
Padua
Bologna
Florence
Rovigno
Pola
Zara
Segna
Fiume
Gorizia
Aquileia
Ortona
Lanciano
Sulmona
Aquila
Manfredonia
Barletta
Trani
Andria
Terra di Bari
Imola
Faenza
Forli
Ravenna
Rimini
Pesaro
Fano
Sinigaglia
Loreto
Macerata
Ascoli
Teramo
Pescara
Vasto
Termoli
Foggia
Lucera
San Severo
Benevento
Capua
Gaeta
Sora
Veglia
Cherso
Pago
Lesina
Vieste
12 13 14 15 16 17
46 45 44 43 42 41
from Greenwich

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Longitude East 11 from

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8
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42
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37
G. of Sagone
P. Provenzale
C O R S I C A
I. Sanguinario
Ajaccio
Bogognano
Mt. Rotondo
Mt. Capella
Aleria T.
Urbino L.
Venaco
Vivaro
Palo L.
Pila
R. Talava
Mt. Calva
C. Muro
R. Velinco
Olmeto
Propriano
P. Favone
P. Pinarello
Eccica I.
Sartena
Porto Vecchio
P. Tizzano
Cipricaglie Is.
Toro I.
Monachi
G. of Ventilegne
G. of Sa. Manza
Cavallo I.
Strait of Bonifacio
Bonifacio
I. Sa. Maria
T. Sa. Reparata
Maddalena I.
Caprera
M. Scommunica
Asinara I.
C. Vignola
P. Congianus
Mortorii Is.
C. Falcone
G. of Asinara
R. Coguinas
C. Figari
M. Argentaro
Torres P.
Cas. Sardo
Aggius
Tavolara
Cas. Doria
Tempio
Terranova
Molara I.
Sennori
Nulvi
C. Codacavallo
C. Gesso
Sassari
Sorso
Osilo
Ploaghe
Oschiri
Petrosa
C. Caccia
Alghero
CAPO DI SASSARI
Codrungianus
Posada
Mt. Leone
Ozieri
Buddusò
C. Comino
Villanova
Mores
Pattada
M. Albo
Siniscola
Padria
Bonorva
Bitti
C. Marargiu
Macomer
Bono
R. Termo
Bosa
Illorai
Orani
Nuoro
Orosei
M. Ferru
Cuglieri
Oliena
Dorgali
S. Lussurgiu
Ottana
Baunei
Ghilarza
Fonni
C. Monte Santo
S A R D I N I A
Pelosa I.
C. Manna
Tonnara
Lozzorai
Maldiventre I.
Cabras
Tortolì
C. Bellavista
Coscia
Oristano
Aritzo
Lanusei
C. S. Marco
G. of Oristano
Samugheu
Bari
C. Frasca
Marrubiu
Nuralleo
M. Cuadazzoni
Mt. Arcuentu
Terralba
CAPO DI
C. Sterra Cavallo
Isili
S. Giov. di Sallaro
Pabilonis
Sardara
Guspini
Seddori
Mandas
Chirra I.
Samassi
Villapuzzu
C. Pecora
Villacidro
Selegas
S. Vito
Iglesias
CAGLIARI
Muravera
Domusnoas
Siliqua
Monaster
Sinnai
Settimu
C. Ferrato
Quartu
S. Pietro I.
Massargiu
Carlo F.
Caputerra
CAGLIARI
Serpentaria Is.
S. Antioco I.
Villarios
Cavoli I.
Pula
C. Carbonara
Vacca
Teulada
Toro
G. of Palmas
Rosa
C. Spartivento
C. Teulada
Clementino
Civita Vecchia
PATRIMONIO DI S. PIETRO
Oriolo
Bracciano
Riano
C. Linaro
S. Severa
T. Flavia
Palo
La Storta
Tivoli
Lorio
ROME
Poli
Maccarese
R. Tiber
Marino
Fiumicino
Isola Sacra
Ostia
Dragoncella
Albano
CAMPAGNA
Anagni
Paterno
Pratica
Segni
Cisterna
Lorenzo T.
Tre Ponti T.
Nettuno
Pt. d'Anzo
Astura
L. Paola
C. Circello
Zannone
Palmarola
Ponza
Botte
M E D I T E R R A N E A
C. S. Vito
S. Vito
G. of Castel a Mare
S. Helena Tonnara
Sopella
Levanso
Maritimo
Trapani
Favignana
Saline
Cornisi
Calatafimi
Salemi
C. Boeo
Marsala
Caciecavallo
Mazzara
Castel Vetrano
L. Cantaro
C. Granitola
Manfrici
R. Caribi
C. S. Marco
Sciacca
Calatabalotta R.
C. Bianco
PALERMO
Galita Is.
C. Blanco
Serrat
C. Farina
C. Bon
Town
Pantellaria
Sciarra P.
P. Finestra
Tunis
A F R I C A
9
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12
Longitude East 13 from Greenwich

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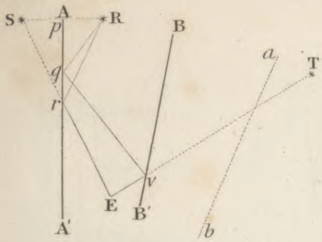
Fig. 1.


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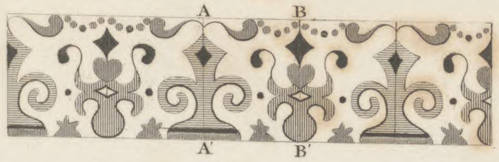
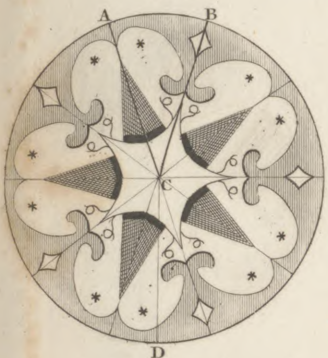


Fig. 3.


Fig. 4.


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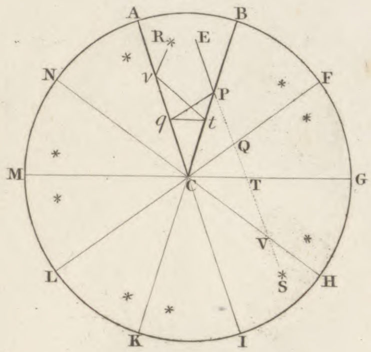

Fig. 6.


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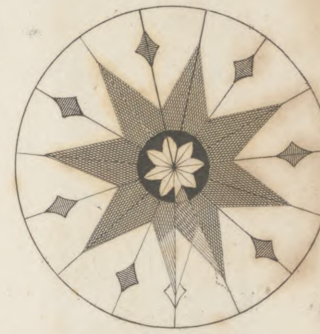

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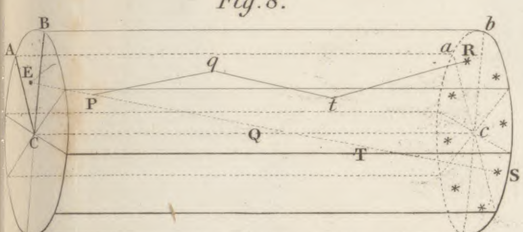
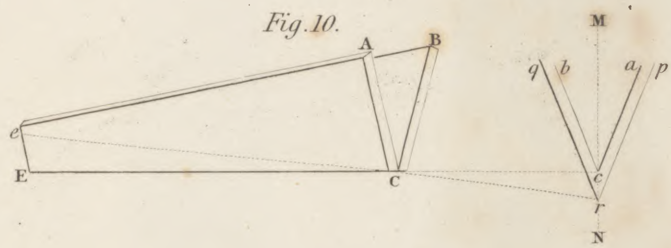


Fig. 9.


Fig. 10.


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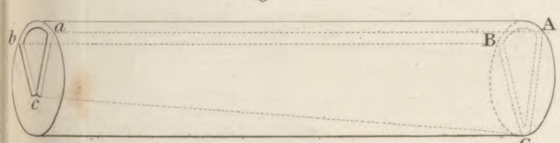

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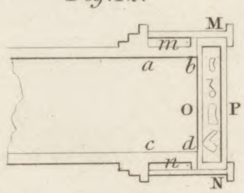
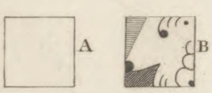


Fig. 13.


Fig. 14.


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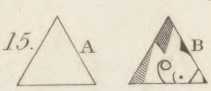

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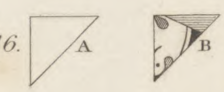

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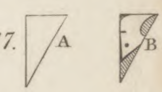

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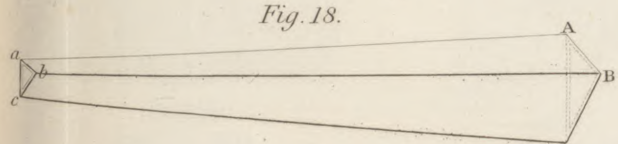

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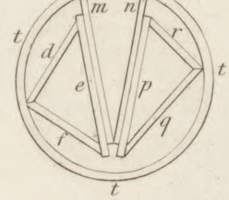

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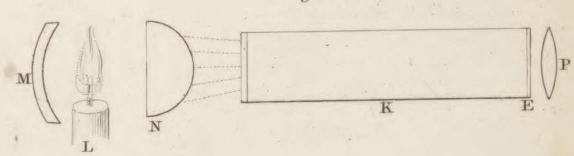
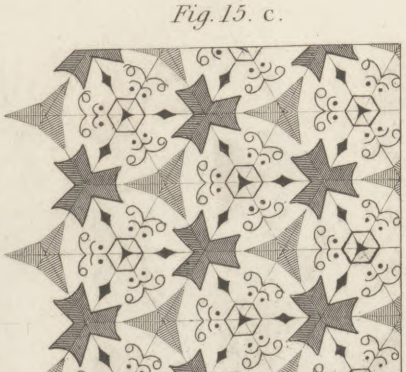


Fig. 14. c.


Fig. 15. c.


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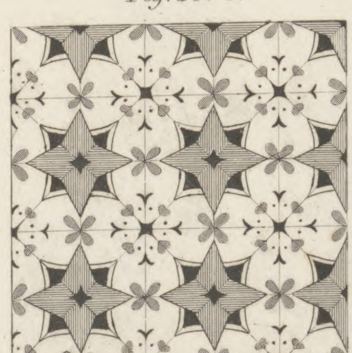

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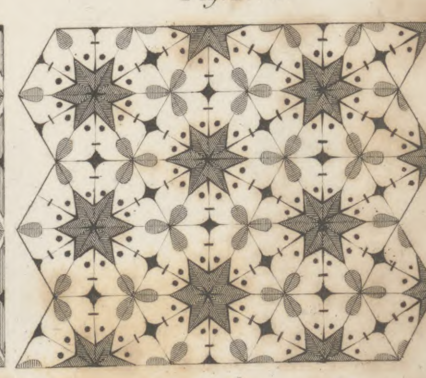
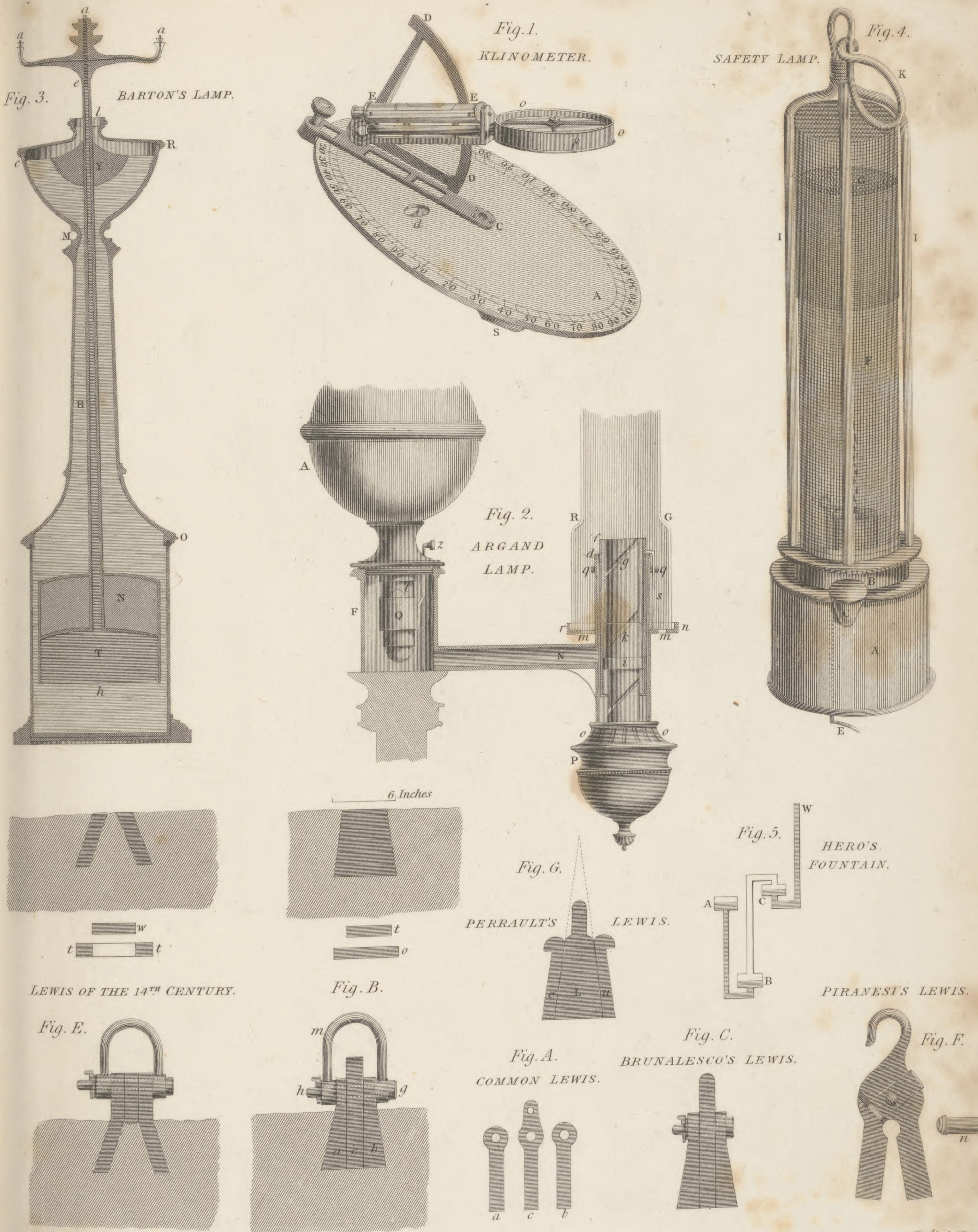


Engd by G. Aikman.

KLINOMETER. LAMPS. LEWIS.

PLATE CCCXXI.



J. Farey. Delt.

Engd. by G. Aikman.